DEC 20 1932

ELECTRICAL WORLD

December 17, 1932
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Company, Inc.

Gold Bricks

"I talked with the electric light and power people and they all want a load on the line — but they want to get it for nothing. I talked with range manufacturers, and they all want ranges sold — but they want to have it done for nothing. They want to put up the money to sell ranges — after the ranges have been sold. The electric light and power people are willing to put up the money for additional load on the line — after they get the load. Unfortunately, the money must be put up first in order to pay the expense of selling the idea, inducing people to believe in electric cookery and buy ranges, and getting the load on the line.

P. S. ARKWRIGHT
Chairman Electric Cookery Council"

Something for Nothing

. . . that's the appeal that sells gold bricks — but it won't sell ranges

If the load is worth having it's worth fighting for

Adequate promotion will sell the range to America TODAY

Since the diversity of the future residential load will become more varied—by the addition of heavy duty appliances such as ranges and water heaters—it is excellent business policy to install on new and replacement services the multiple service equipment pictured below. This will mean considerable saving to the customer and to your distribution department in reducing expenses and in eliminating delays. The installation of this multiple service equipment is of tremendous value when new appliance sales are being considered.

MURRAY
MULTIPLE SERVICE
SWITCH

Cat. No. 278 consists of a 60 Ampere Safety Switch and Main Fuse, a meterboard, a sealable compartment for the meter test block, a distribution panel containing fuses for a range circuit, a 240 volt water heater circuit and four 15 Ampere 120 Volt lighting circuits. Cat. No. 277 similar to No. 278 except that meter test block is supplied.

"ON" position showing distribution and water heater fuse compartment open—terminals are shielded from contact by "dead front" panel.

"OPEN DOOR" position—main fuses and range fuses accessible. Service disconnected.

WRITE FOR CATALOG TODAY

METROPOLITAN DEVICE CORPORATION, 1250 Atlantic Ave., BROOKLYN, N. Y.

ELECTRICAL WORLD

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for the Week Ending

December 17, 1932

Middle West Receivers Seek R.F.C. Aid

Dominant among the big problems before Middle West Utilities receivers is that of protecting the company's $40,000,000 investment in Eastern utilities. Postponement of auction sales of collateral holdings by New York banks has been effected at intervals and once more a crisis developed when the Central Hanover Bank & Trust Company of New York announced its intention to auction collateral held.

It is reported that E. N. Hurley, co-receiver, has been in Washington to confer with officials of the Reconstruction Finance Corporation as to a loan to protect Middle West interests. Legal opinion is divided as to whether such a loan could be made, but apparently some results were had, for the Central Hanover later stated it had postponed its auction. A loan of some $21,000,000 through a bank or trust company would be the only available method for aid from the R.F.C.

In the meantime work is being done to unify the Eastern properties under the Irving Trust Company as receiver to replace the present administration of the various bank creditors. It is doubtful whether the interests of Middle West stockholders can be protected because practically all the assets of the Eastern group were pledged with banks or under debenture issues by the former management and there has been a subsequent shrinkage in earnings because of the depression and because of changed accounting methods.

The first meeting of the directors of the Middle West Utilities Company since the inclusion of the operating property heads was held in Chicago last week. Three new directors were added and J. E. Barber and A. W. Moore were elected vice-presidents. M. P. Koch was chosen controller. After the meeting the receivers said a central organization to provide legal, tax, purchasing, accounting and other facilities for the operating properties was being established in Chicago. Plans for the coming year include further reduction in operating costs.

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Law on Power Sites' Revenue Asked by Federal Bureau

Federal legislation for a final disposition of power revenues from power units of reclamation projects is sought by Commissioner Elwood Mead of the Bureau of Reclamation in his annual report to the Secretary of the Interior, made public this week. "The Bureau of Reclamation has taken the position," Dr. Mead states, "that the power plants which are built with government funds or which utilize power opportunities created by such expenditures should be the perpetual property of the federal government and that the profits resulting therefrom should be used to further the work of reclamation."

In the report the bureau takes the position that the profits from these power plants should be applied to the repayment of the construction cost of the power system, to aid in repayment of the construction cost of the dam or other structure which creates or makes possible the power development and to the reclamation fund to be used in the construction of additional works. The reason for this policy is that in every case these works have been wholly built at the cost of the government. "It is hoped," the report concludes, "that the next Congress will enact legislation to determine the disposal of power revenues and that this claim of the water users on power plants to have these revenues as a profit on the investment made by the government will be finally disposed of."

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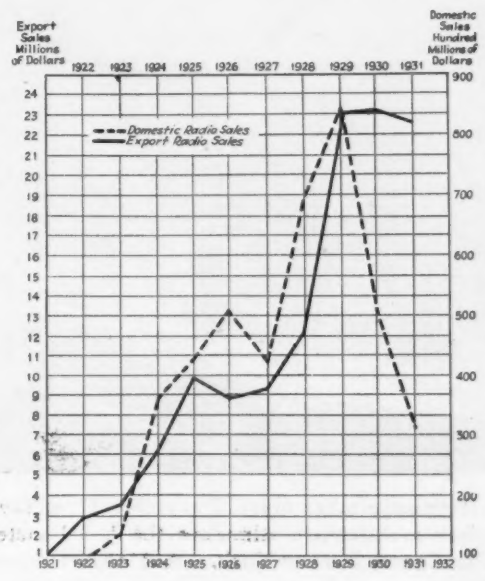
Export Sales Millions of Dollars
Domestic Sales Hundred Millions of Dollars
1922 1923 1924 1925 1926 1927 1928 1929 1930 1931
Domestic Radio Sales
Export Radio Sales
1921 1922 1923 1924 1925 1926 1927 1928 1929 1930 1931 1932

Radio Retailing

The Rise and Fall of Radio

Precipitously dropping off from the heights of dizzy 1929, the radio industry has seen its business go back to the levels of its early struggles in 1924.

For this year there will presumably be further declines of 35 per cent or so. The notable resistance offered by the export business is interesting, but exports are less than 7 per cent of the domestic trade.

Co-operation in Merchandising Brings H. P. Liversidge the McGraw Award

THIS year the judges appointed from the directorate of the Society for Electrical Development have awarded the James H. McGraw medal for co-operation and $100 purse to H. P. Liversidge, vice-president of the Philadelphia Electric Company. This is in recognition of his distinguished contribution to the advancement of co-operation in the electrical industry by his leadership in the city of Philadelphia in the development of a practical co-ordination between electrical men for the improvement of business standards and the promotion of the market and by the influence of his work for tolerance and harmony of purpose in the national policies of the industry.

The presentation was made on December 14, at a dinner held in Philadelphia, and sponsored by the Electrical Association of Philadelphia. The committee of judges which awarded the medal to Mr. Liversidge consisted of George E. Cullinan, Laurence W. Davis, Leavitt L. Edgar and S. L. Nicholson.

In 1925 this medal and purse were awarded to J. Robert Crouse, in 1927 to W. Winans Freeman, in 1928 to Henry H. Courtright, in 1930 a posthumous award to Charles T. Hutchinson and in 1931 to Thaddeus R. Beal. In 1926 and in 1929 no medals for co-operation were given. An abstract of the citation for the award follows:

Horace P. Liversidge, vice-president and general manager of the Philadelphia Electric Company and president of the Electrical Association of Philadelphia, has exerted a far-reaching influence in the progress of co-operation in the electrical industry. Four years ago, when the management of the company was changed, he set himself to expounding the principles and advantages of co-operation within his own company, to synchronize the policies of the utility with the essentials of intelligent trade practice and to establish harmony within the electrical industry. He assisted in the reorganizing of the Electrical Association, established to promote the common interests of electrical men in Philadelphia, and became its president.

He threw himself wholeheartedly into an ambitious program of sales promotion and industry service, designed both to advance the prosperity of the local electrical business and to demonstrate the practical common sense of organized co-operation as contrasted with the chaos of destructive, lone-wolf competition. Under his leadership an Electrical Institute was established as a permanent educational exhibit; electric, radio and refrigeration shows were held, co-operative campaigns were conducted, the adequacy of wiring installations was increased, estimating, merchandising and accounting methods of members were improved through an educational service and the standards of business policy and conduct were elevated through the upbuilding of a more friendly spirit of interdependence and responsibility among all classes of electrical men. This influence has gradually been extended until it now embraces some 88 communities and the 144 townships served by the Philadelphia Electric Company system.

All this has been done in a time of extreme difficulty and unrest. His achievement has been the more notable because out of a technical training and an operating experience in power company engineering and administration he has become the outstanding exponent of a practical co-ordination in sales policies and the trade relationships between the five branches of the electrical industry, not in his own community alone but nationally.

Believing . . . this . . . a constructive contribution to the advancement of co-operation in the electrical industry . . . the judges have awarded to Mr. Liversidge the medal and purse for co-operation for 1932 given under the James H. McGraw award.

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Energy Tax Rulings Made by Internal Revenue Bureau

Electrical energy furnished to closed industrial plants during the period of their inactivity is commercial energy, and sums paid for such power, whether used

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LIGHTING THE MOST MODERN THEATER

When the gala inaugural performance takes place, December 27, a favored 6,000 will see a new theater of wonders. Lighting and modern architecture stimulate the jaded taste of theatergoers at this new Roxy Music Hall at the Rockefeller Center in New York. A $166,000 console board controls all the lighting.

or not, are subject to the 3 per cent tax levied by the revenue act of 1932, the Bureau of Internal Revenue has ruled in interpretation of a phase of Section 616 of the act.

Another important ruling recently announced with respect to the 3 per cent tax on electricity applies to the extension of transmission lines by a power company to rural subdivisions under an agreement with the consumers that the expense of such extensions shall be paid in monthly installments. The ruling states that the installments so collected are not taxable, even though billed with the regular charges for electricity, as they represent solely the cost of the extensions, and are separate and distinct from charges for electrical energy.

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Superpower Proposes Stock Exchange

American Superpower Corporation has made an offer to its first preferred stockholders to exchange a limited number of the first preferred shares for its holdings of United Corporation $3 cumulative preference stock. The corporation announces that the basis of exchange will be two shares of United Corporation preference stock for one share of American Superpower Corporation first preferred. The offer will expire at the close of business December 27, 1932. The stock will be acquired for the purpose of retirement.

Superpower Corporation owns 274,678 shares of the United Corporation's stock and these will be offered in exchange for 137,339 shares of Superpower stock. The exchange does not affect the net income of the corporation, but will enable it to retire this amount of its preferred stock.

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California Commission Advocates Assessment

Assessment of utilities rather than an appropriation from the general fund is advocated by the California Railroad Commission as a method to finance utility regulation. In a letter to Governor Rolph of California the commission summarizes its report for 1931-32 and makes this and several other recommendations.

The commission thus follows a trend evident in Oregon, Wisconsin and some other states. During the year the California commission ordered new rates that reduced bills $1,655,948 and increased rates to the amount of $8,894. It reports an investment of $3,000,000,000 in the public utility industry in California and these utilities did a gross business of $523,000,000 in 1931, as compared to $574,000,000 in 1930.

Nero Was a Piker at Inaction

Towering above every other influence and fact of the week have been the war debts. The bad feeling and misunderstanding which the failure to reach a working solution engendered, culminating so badly abroad and with a move to impeach the President here, will doubtless tower likewise through the years to come. International trade and well-being cannot be resumed while throttled by unsolved debt, prohibitive tariff and depreciated currency problems. It is one of the high tragedies of things as they are that one of the few major difficulties about which any concerted intelligent action could have been taken should have drifted to its present status. Perhaps it is but another proof of our aggregate inability to face unpleasant facts and act upon them.

Even as in the plight of the farmer, of the unbalanced national budget and of the public, corporate and private debts that must eventually be written down, it is easier to ignore the matter or devise fantastic evasions than to act upon the obvious necessity. Here is once more, however, the familiar certainty that eventually economics must win. Sooner or later the best over-all way which considers dollars and results will triumph, though the cost of adjustment be ever so high.

Latest figures for carloadings and energy production show gains; coal output dropped after showing strength in the last half of November. Commodity prices, except for some present speculative favorites, have been notably weak, with general averages back to the levels of last July. Copper touched an all-time low of 5 cents a pound upon failure of negotiations to effect curtailed production agreements. No clear trend in general business and no upraising influences appear. The next significant point may be the first of the year.

This has been a hydro year for electricity generation, it seems. Energy produced by water power is 10 per cent above last year, while that produced by fuels is off 17 per cent.

The commission believes that all loans of public utilities from their stockholders or to their stockholders or from or to affiliated corporations should be placed under its control.

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Capital Write-Down Plan by United Gas Corporation

A special meeting of stockholders of United Gas Corporation has been called for December 29 to consider and act upon a proposal to reduce the amount of capital represented by the common stock from $14.91 per share to $1 per share and to change all present common stock without par value into an equal number of shares of $1 par value. This change is made possible by a reorganization and simplification program begun in 1930, when the corporation acquired 40 separate operating and holding companies in various communities.

The underlying structure contemplates only one operating subsidiary and the elimination of intermediate holding companies. Auditors are setting up the plant and investment account of the United Gas Public Service Company, the operating subsidiary, at a lower value than has heretofore been reflected on the books and the stock and capital adjustments of United Gas Corporation reflect these changes. After making the capital adjustments the surplus will be about $14,000,000.

This news from this Electric Bond & Share subsidiary shows a definite goal of industry executives to simplify corporate structures and to adjust capital and investment values to present business and financial conditions.

Federal Commission Seeks Added Investigatory Power

Legislation to put beyond question the authority of the Federal Trade Commission to make investigations at the request of the President or Congress is advocated in the annual report of the commission for 1932 submitted to Congress December 12. The commission suggests an amendment to the Federal Trade Commission act, made in previous annual reports, which might set at rest any doubt as to the commission's power to subpœna witnesses and to procure documentary evidence it requires for investigative purposes.

Investigation nears close

In commenting on the public utility hearings held during the year the report states: "Field work of the entire investigation is expected to be completed during the fiscal year 1932-33. Most of the large holding company groups and a few of the smaller ones will have been taken up when the investigation is completed. Most of the principal holding, management and servicing companies in each of these groups will also have been taken up and a number of operating companies considered. The total material collected will, it is believed, represent a good cross-section sample of the conditions among such companies in the electric utility field." . . .

Among groups yet to be examined are Cities Service Company (Doherty), Niagara Hudson Power Corporation (Morgan), Central & Southwest Utilities Company (Insull), and United Gas Improvement.

Coming Meetings

American Association for the Advancement of Science—Annual convention, Atlantic City, N. J., Dec. 27-31. C. F. Roos, Smithsonian Institute, Washington, D. C.

American Physical Society — Annual meeting, Atlantic City, Dec. 28-30. W. L. Severinghaus, Columbia University, New York.

American Institute of Electrical Engineers—Winter convention, New York, Jan. 23-27. H. H. Henline, 33 West 39th Street, New York.

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52 per Cent Rate Cut Asked on Basis of Property Write-Ups

Contending that the Old Dominion Power Company, part of Middle West Utilities, has inflated its fixed capital assets to such an extent that its effective rates in the wholesale classification should be drastically reduced, the Virginia Coal Operators' Association has recently petitioned the State Corporation Commission for reductions in wholesale power schedules of approximately 52 per cent.

It is stated that because of alleged arbitrary and excessive write-ups and failure to charge off abandoned and non-useful power plants, the company's fixed assets, "used and useful in the production, sale and distribution of electric power in Virginia," are carried at $5,259,168, whereas they should be $2,509,474.

Douglas Terpstra, consulting engineer for the coal operators' association, stated that since 1925 the coal mines' rates had been increased 23 per cent, while other consumers had been granted an 11 per cent decrease. Following his testimony the commission suspended further hearings until December 28, when the power company will introduce a property valuation now under way.

The commission has ordered Old Dominion Power to file with it various ledgers, journals, etc., for examination.

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Retirement Charges Too Low, Says Alabama Commission

An increase of $1,100,000 in Alabama Power Company's retirement reserve fund for 1932 has been ordered by the Alabama Public Service Commission, after disapproving a five-year plan proposed by the company. Operating expenses would be charged with $900,000 and $200,000 would come out of surplus. Total charges against the retirement reserve fund for the current year will approximate $1,000,000, the company reported. As of August 31, 1932, it had an accumulated reserve of $3,440,450.

The order was based on a general order of the commission requiring utilities of the state to pay no dividends until they have earned surpluses to cover them and to establish proper reserve funds.

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St. Paul Utilities Revalued for Rate-Making Purposes

Maintaining that for some time past the rates charged by the Northern States Power Company have been high and that the city is not getting the benefit of the present depressed condition of prices, the city of St. Paul, Minn., has undertaken a revaluation of the electric, gas and steam-heating plants of that company. The city decided to undertake this revaluation work when its requests for reduced rates failed to be acted upon by the company.

The firm of Burns & McDonnell of Kansas City has been engaged at a contract price of $42,500. The city will supply the services of eight engineers and accountants. The time for the submission of the report has been set at seven months.

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Virginia Commission Asked to Investigate Rates

Following the recent report on public utility rates in Virginia made by John Bauer of New York at the instance of the League of Virginia Municipalities (ELECTRICAL WORLD, December 3, page 744), W. C. Hall, a member of the Virginia House of Delegates, in a letter addressed to the state Corporation Commission has requested immediate institution of an investigation to determine whether or not electric rates should be reduced.

Under the present laws and court decisions governing the regulation of utility rates the corporation commission can require reductions only after a valuation of the properties of the company has been made. The corporation commission at present has no funds with which to finance a valuation of all the properties of the three major companies dealt with in the Bauer report—the Virginia Electric & Power Company, the Virginia Public Service Corporation and the Appalachian Electric Power Company. There appears to be some doubt whether the corporation commission can require the production of certain books and facts, not now ordered in the annual reports of the utility companies.

Power companies in Virginia will not object to a competent investigation of their valuation, operation and rates. J. G. Holtzclaw, president Virginia Electric & Power Company, has characterized the report of John Bauer, director of the American Public Utilities Bureau of New York, as "unfair and unjust." J. W. Hancock of Roanoke, Va., president of the Appalachian Electric Power Company, asserts that his company "had nothing to fear" from an investigation and that its rates were fair and reasonable. Floyd W. King of Alexandria, Va., executive vice-president of the Virginia Public Service Company, said: "We would be glad for an investigation either by the proper state body or a qualified engineering firm." Both Mr. Hancock and Senator King said that Mr. Bauer has not made an investigation of their properties.

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Lamp Renewals Scored at Boston Edison Hearing

Boston Edison was charged with making an annual profit of $1,000,000 on its "free lamp renewal racket" at the recently continued hearings before the Massachusetts Public Utilities Commission. Petitioners for a rate reduction asserted that the company is allowed to charge a half cent per kilowatt-hour in its rate because of its policy to renew lamps without charge. It was contended that as a result of this authority the company was able to make a profit of $1,000,000 a year and that the company has discontinued giving 50-watt lamps, "so that 60-watt lamps are the smallest you can obtain under this system." Because of the alleged failure of the company to renew the 50-watt bulbs, it is said that energy use has been increased 20 per cent. J. W. Cowles, superintendent of the installations department, defended the free lamp renewal policy. Last year the company's lamp service cost it about $540,000.

Two members of the commission following these charges expressed the opinion that "the entire lamp situation should be gone into thoroughly." Similar agitation arose in Chicago and Detroit some time ago (ELECTRICAL WORLD, May 21, page 880, and August 13, page 200, and December 10, page 773).

Witnesses from the company called by the opposition included Sidney Hosmer, vice-president and general manager, who explained the problem of coal purchasing and pointed out that the company's present annual consumption of almost 400,000 tons represents too large an order for all but a few coal concerns to consider handling. Superintendent Goodman of the statistical bureau of the company told of methods used in arriving at various rates in the company's rate structure. He stated that the trend has been to reduce electricity costs to the small consumer as power business has developed. He pointed out that the Department of Public Utilities reduced the maximum rate of Edison company from 9½ cents in 1922 to 7½ cents at present.

Employee Security Sales Before Trade Commission

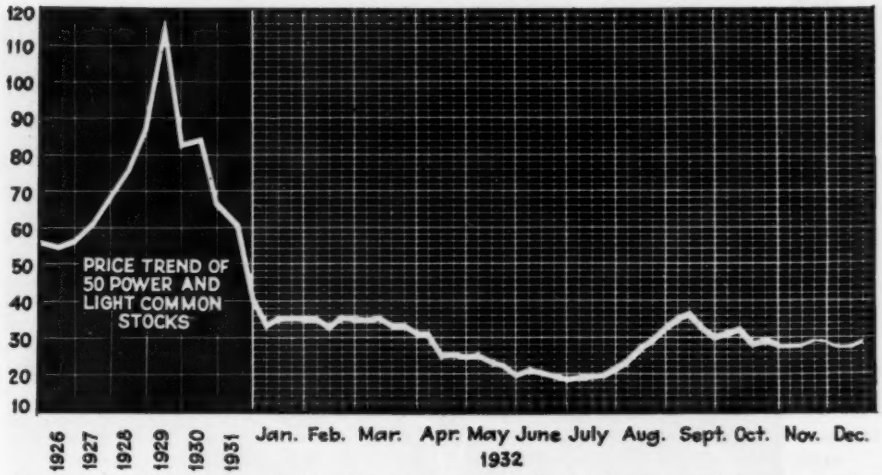
In resuming its investigation of the New England properties of the Associated Gas & Electric Company the Federal Trade Commission called as a witness Frank H. Golding, president of the New England Gas & Electric Association, who testified that a substantial portion of the employees of the operating companies of the association were licensed to sell securities of the Associated Gas & Electric Company and of other system companies outside of the New England group. These employees were only compensated for security work when they were on full or part time for security selling, and not when their security selling activities were carried on without interfering with their regular duties, he testified.

At a subsequent hearing the commission transferred its inquiry to the affairs of the Pennsylvania Electric Company, subholding company of Associated Gas & Electric. Charles Nodder, examiner, stated that the company was organized by interests associated with H. D. Wallbridge & Company, who at the time of organization controlled the companies merged and consolidated to form the Penn Public Service Corporation. The control of the company passed to Associated interests in 1925, through acquisition of the capital stock of Pennsylvania Electric Corporation, which was the vehicle through which Wallbridge interests held control of the properties in western Pennsylvania, of which Penn Public Service was the principal operating company.

Mr. Nodder stated that intangible values to the amount of $4,981,561 were included in the fixed capital installed prior to January 1, 1919, and that from the facts developed in his report of the examination of the company's books the "write-ups" and intangible values in fixed capital on the books at the close of 1929 include items totaling $17,284,353.

During the period from January 1, 1921, to September 23, 1925, when Associated interests acquired control, the company paid $566,135 in management fees to H. D. Wallbridge & Company. Following acquisition by Associated interests, the examiner stated the company paid fees under two contracts on the basis of 2½ per cent of gross revenues. The total amount paid under these contracts from September 23, 1925, to April 30, 1928, aggregated $427,000. From May 1, 1928, to the close of 1929 payments at 2½ per cent of gross revenues made to the J. G. White Company under a new contract totaled $326,308. The total payments for managerial services, at the rate of 2½ per cent of the gross revenues, from 1921 to the close of 1929, the examiner testified, amounted to $1,364,476. The entire amount, he said, appears to have been charged on the books of the Pennsylvania Electric Company to the expense account entitled "other general expenses" in each of the three general departments of the company's operations—electric, gas and heating.

Utility Stocks Slightly Higher



Prices of utility stocks during the past week followed the general trend, moving within a narrow range. Changes were sufficient, however, to carry the "Electrical World" index up one point—from 27.6 to 28.6.

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Inland P. & L. Corporation in Receivership

Upon the application of Commonwealth Light & Power Company an equity receiver has been appointed for the Inland Power & Light Corporation, $47,000,000 subsidiary of Middle West Utilities Company, by Judge Walter C. Lindley in the United States District Court in Chicago. Commonwealth Light & Power owns all the common stock of the Inland organization. Petition for the appointment of the receiver alleged that the company, although solvent, has not sufficient money on hand to meet debenture interest due December 1 or the next installment of interest due on its collateral trust bonds and that under existing conditions it will not be able to pay interest on these bonds.

The petition further alleged that Inland Power & Light is indebted to Commonwealth Light & Power in the amount of $1,840,087, of which $1,635,658 are advances evidenced by notes partially secured by collateral, all of which notes are now due and unpaid, and that Commonwealth owns $51,600 of 7 per cent debentures of the total $1,161,900 issue of Inland Power & Light. It was further charged that investments of Inland Power cost $8,947,278, but that they have shrunk extraordinarily in market value; that earnings of subsidiaries are decreasing and may reasonably be expected to decrease further, and that dividends on their stocks held by the parent company will be passed. Inland Power & Light admitted the allegations and consented to the appointment of a receiver.

While ownership of Inland Power is vested in Commonwealth Light through ownership of the entire common stock, Commonwealth, in turn, is controlled by Middle West Utilities Company through ownership of 56,447 shares of common stock of the 85,345 shares outstanding. Middle West also owns $1,002,600 of Inland Power collateral trust bonds and $228,100 of 7 per cent debentures, all pledged against bank loans.

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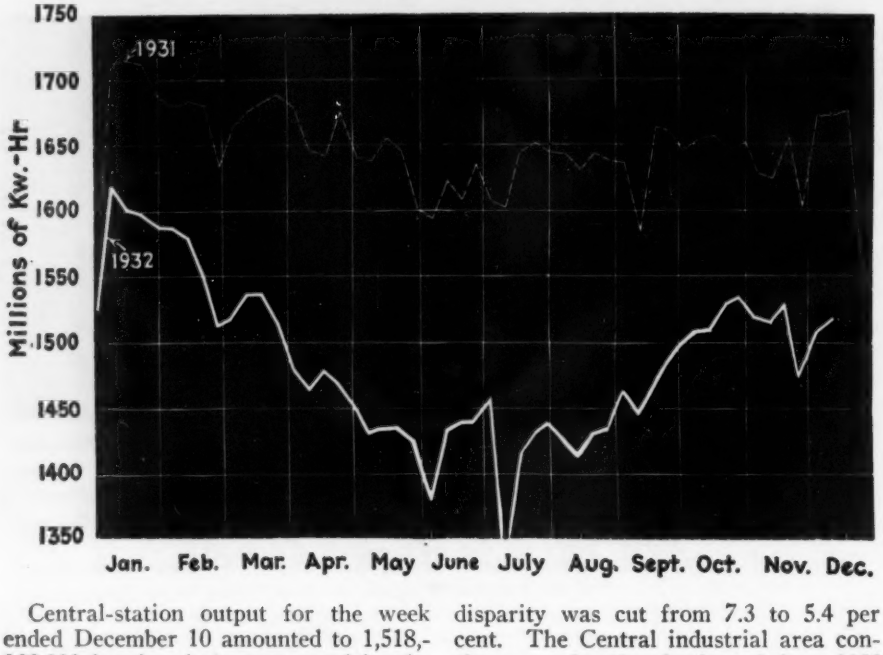
Oregon Utility Inquiry Broadened by Commission

Investigation of Oregon properties of American Power & Light Company, in which Federal Power Commission aid was invoked (ELECTRICAL WORLD, November 26, page 708), has been broadened by the recent order of Oregon's utility commissioner to include examination of the capitalization, corporate affiliations, practices, management, salaries and general dealings of the Portland Gas & Coke Company, Pacific Power & Light Company, Inland Power & Light Company and Northwestern Electric Company. Contracts held by Electric Bond & Share Company providing for payment of general service by these and affiliated companies, including Phoenix Construction Company, are also to be scrutinized, under the order of the commissioner.

Week's Output Rises 8,600,000 Kw.-Hr.



Central-station output for the week ended December 10 amounted to 1,518,922,000 kw.-hr., it is announced by the National Electric Light Association. Compared with 1,671,717,000 kw.-hr. a year ago, this constitutes a decrease of 9.1 per cent and indicates a partial recovery from the deficiency of 9.6 per cent of the preceding week, but fails by some 50,000,000 kw.-hr. to conform with the pronounced rise that was in progress during the late summer and early autumn.

The improvement over the preceding week was quite uniformly distributed, each geographical region showing a closer approach to 1931. The greatest gain was in New England, where the disparity was cut from 7.3 to 5.4 per cent. The Central industrial area continues to be the farthest below 1931 operations. On the Pacific coast the showing is somewhat better than in early November.

Weekly Output, Millions of Kw-Hr.

Week Ended	1932	1931	1930	1929
December 10	1,519	1,672	1,748	1,841
December 3	1,510	1,671	1,747	1,806
November 26	1,475	1,600	1,672	1,718
November 19	1,532	1,655	1,722	1,818
November 12	1,521	1,623	1,713	1,794

Per Cent Change from 1931

Region	Week Ended Dec. 10	Dec. 3	Nov. 26
Atlantic Seaboard	— 7.4	— 7.7	— 5.6
New England alone	— 5.4	— 7.3	— 3.7
Central industrial	—11.1	—12.3	—10.2
Pacific Coast	— 7.7	— 7.9	— 7.9
United States	— 9.1	— 9.6	— 7.8

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Rate Arbitration Plan Rejected in Akron

City officials of Akron, Ohio, seeking to avoid presentation of a fight for lower electric rates to the state Public Service Commission, with the ostensible plea of avoiding the considerable expense and delay which might be involved, have failed to convince representatives of the Ohio Edison Company that an arbitration board should decide the issue. Mayor Sparks proposed that a commission of three engineers, one representing the company, one the city and the third as referee, expedite matters. L. G. Tighe, vice-president of Ohio Edison, asserted that the company should not surrender any of its rights to a third party. The utility would stand by its original proposal for a joint appraisal, he stated, adding that such an inventory and appraisal would require at least two years for completion.

The power company offered a rate reduction involving an estimated annual saving of $30,300 to domestic users and $90,000 to commercial users, but this was spurned by the utilities committee of the City Council, which interpreted it as a 5-cent-a-month saving on each customer's bill. "The only answer the company has had to its revision proposal is an ordinance calling for a 25 per cent rate slash," Roy H. Nesbitt, company counsel, told the negotiators. The controversy is headed for the Public Service Commission, he added, if City Council upholds the ordinance.

The company's franchise expires December 20. Reports that the Cleveland Electric Illuminating Company is considering asking for a franchise in Akron are denied by officials of that organization, who told the Akron City Council committee that should any such move have been considered a rate higher than Akron now pays probably would have to be asked.

Canadian Energy Down But 2.5 per Cent from 1931

Like those in the United States, central stations in Canada have been generating less energy this year than last, which in turn was under 1930, but the approach of our northern neighbor to 1931 is closer than ours. (ELECTRICAL WORLD, October 15, page 518.) October production, reported by the Dominion Bureau of Statistics as 1,390,128,000 kw.-hr., was down only 2.5 per cent from last year; in the United States the disparity was 9 per cent. Compared with 1930 the Canadian decrease was 11.6 per cent, with 1929 12.7 per cent. Over September there was a gain of 8.7 per cent.

Output from water power in Ontario was 348,530,000 kw.-hr., a decrease of 9 per cent; in the Maritime provinces 50,889,000 kw.-hr., down 8.7 per cent; in British Columbia 94,848,000 kw.-hr., down 6.3 per cent. More than half of the Dominion total was produced in Quebec—763,577,000 kw.-hr., a gain of 3.7 per cent over 1931.

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British Board Puts Rates on Flat Energy Base Plus

Tariffs for the mid-east England district, one of the two areas now ready to be served from the grid of the Central Electricity Board, have been announced. While the details of the rates may vary for the different areas, the present announcement is construed as the standard form which the subsequent rates will take. Energy is to be sold to the municipal and private undertakings at the flat rate of about three-eighths of a cent, regardless of quantity, taking the pound at its old approximation of five dollars.

On top of this will be a demand charge which starts at approximately $15 per kilowatt annually for the basic demand, which is the actual 1932 figure of the undertaking, or 2,000 kw., whichever is the greater. Successive increments of demand above the basic value are charged at progressively lower rates down to $13.75, the size of the increment blocks decreasing from 3,000 kw. to 1,000 kw. for basic demands ranging from not exceeding 3,000 kw. to 22,000 kw. and over. Maximum demand is calculated as twice the largest number of kilowatt-hours drawn from the board during any half hour in four winter months.

If the service is taken at more than one point the board will impose a service charge, which, in part, will insure that the board is recompensed by local undertakings which thus make use of the grid as a substitute for a local tie line or feeder. A power factor penalty is set on demand for all power factors

less than 85 per cent at a rate of about $0.12 for each 1 per cent less than the norm of 85 per cent. The energy charge is also modified for fuel cost departure from 11,500 B.t.u. and $3.75 coal; the correction is one mill per dollar change in the cost of fuel heat.

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Georgia Revaluation Move Dropped Because of Expense

Efforts of the city of Atlanta and Municipal Utilities Rate Association to have a revaluation made of the property of the Georgia Power Company at the resumption of the hearing before the Public Service Commision were chilled by Chairman Perry's query as to who would pay the $400,000 expense that a new survey of the company's property would involve. Protestants contended that the present valuation of $200,000,000 for rate-making purposes should be reduced to $116,000,000.

Georgia Power Company officials continued their opposition to the proposed elimination of the service charge of $1 per month (ELECTRICAL WORLD, December 3, page 740). Charles A. Collier, vice-president in charge of operations of the company, testified that the fixed costs per residential consumer, including meter installations, maintenance, connections, inspections, meter reading, billing and accounting, division office expenses and general overhead, amount to $1.82 per month.

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City-Unit Rate Dispute Argued in Supreme Court

Appeal by the Wabash Valley Electric Company for the reversal of a decision that rates for service supplied one community by the utility must be based upon the value of the property used in serving that community and not upon the company's entire system was made to the Supreme Court of the United States and arguments for both sides were heard last week. The Public Service Commission of Indiana fixed the rates for Martinsville, Ind., by treating the property as a segregated unit in determining the proper charges to consumers of that town, and the lower federal court refused to enjoin the enforcement of the order (ELECTRICAL WORLD, October 22, page 550, and October 29, page 584).

Complaining that the commission's action deprives the utility of its property in violation of the Fourteenth Amendment, counsel for the company told the high tribunal that the company serves 50 different communities, as a unified system, and that the income and property of the entire system must be considered in determining the rate for any one community. He maintained that the court has no right to break down the system and build it up in another way, unless the system is operated imprudently or unlawfully.

Arthur L. Gilliom, Indianapolis attorney, and George W. Hufsmith, assistant Attorney-General of Indiana, testifying for the commission, contended that the system-wide basis was entirely unfair to the city of Martinsville. It was not necessary, Mr. Gilliom declared, to evaluate the entire property in order to find the rate base for Martinsville rates. The local distribution systems in 49 other cities are not employed in giving service to the public in Martinsville and they need not be included to obtain the fair value of the property that is so employed, he maintained.

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Alternative Rate Pact May Speed Kanawha Plant

Pending judicial determination of the question of a state's right to tax hydroelectric dams on federal property, an agreement that alternative rates should be adopted for leasing government property at dams in the Kanawha River in West Virginia to the Kanawha Valley Power Company has been reached by Attorney-General Howard B. Lee and Oswald Ryan, general counsel for the Federal Power Commission. One rate, according to the agreement, should be based on exemption from state taxation and the other upon a basis of state taxation that would total approximately $65,000 annually and would be deductible from lease charges.

Issuance of a permit for the power company's proposed construction of plants costing approximately $4,000,000 has been withheld pending decision on lease charges, which in turn hinge upon taxation. A similar situation, involving the question of a state's right to levy taxes on government property, exists in eighteen other states, Mr. Ryan stated.

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Railroad Air Conditioning Entered by Frigidaire

As the result of successful experimentation with test cars operating in all sections of the country during the past summer the Frigidaire Corporation has just announced its entrance into the railway equipment field with introduction of complete air-conditioning equipment for sleeping cars, club and observation cars, diners and day coaches. A separate factory division has been established in Dayton for the new sales and engineering activity. This unit is known as the "railway air-conditioning division."

Major New Construction This Week

Philadelphia Electric Company has authorized $10,530,000 for expansion and improvement program in 1933, including power plants, power substations, transmission and distributing lines and other structures; about $1,960,000 will be used for extensions in Richmond generating station, now under way, where capacity will be increased by 165,000 kw.

Diesel units, transformers and auxiliaries, pumping machinery, etc., will be installed in new power plant and waterworks station of Brantley County Utilities, Inc., Nahunta, Ga. Electric light, power and water franchise secured. Cost over $100,000.

Motors and controls, machine drives, regulators and conveyors required in rebuilding of paper mill of Eaton-Dikeman Company, Lee, Mass. Cost over $150,000.

Machine drives, motors and controls, panelboards and instruments, conveyors, etc., will be installed in cellulose rayon mill of Tennessee-Eastman Corporation, Kingsport, Tenn. A $1,800,000 project.

Heavy-duty motors, transformers and conveyors required for new refuse incinerator plant of Cleveland, Ohio. Cost about $700,000.

Bids asked until January 12 (extended from December 12) by Aberdeen, S. D., for equipment for city-owned electric plant. An $850,000 project.

"We have worked closely with transportation executives who believe improved and more comfortable travel conditions will bring back to railroads much of the passenger traffic lost to other means of travel," E. G. Biechler, president of Frigidaire, states. "Railroads have provided heating equipment for cars for years. In this age of progress the need for cooling equipment is equally great."

Frigidaire supplies the compressor type, duct or ductless, air-conditioning equipment ready for installation by railroads in their own shops and by their own employees. Since all the equipment is standard, mechanical units and coils are interchangeable so that replacement stocks at shops may be kept at a minimum. All cars will be equipped with thermostatic controls. The compressor is mounted under the car in the Frigidaire system.

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New York Metal Prices

	Dec. 6, 1932 Cents per Pound	Dec. 13, 1932 Cents per Pound
Copper, electrolytic	5.25	5.00
Lead, Am. & S. R. price	3.00	3.00
Antimony	5.50	5.40
Nickel ingot	35.00	35.00
Zinc, spot	3.475	3.475
Tin, Straits	22.50	22.65
Aluminum, 99 per cent.	23.30	23.30

Indiana Utility to Reduce Rates

Permission to reduce rural residential and farm electric service rates in 30 Indiana counties is asked of the Indiana Public Service Commission in a petition filed by the Northern Indiana Power Company. A saving of several thousand dollars a year to the customers will result, according to company officials. The company proposes to eliminate the service charge to farm customers and establish a monthly minimum charge of $2.

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North Carolina Rate Cuts

With reductions in Tidewater Power Company rates, which the North Carolina Corporation Commission has ordered, effecting an annual saving of $25,000, the last of the major utilities operating in the state has been drawn into the movement to lower energy cost to the consumer (ELECTRCAL WORLD, December 10, 1932, page 776). An aggregate saving of $2,000,000 for consumers will result from the new rates, the commission states.

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Utilities P. & L. Decentralizes

Simplified operation and economy are expected to result from the reorganization of Interstate Power Company and Central States Power & Light Corporation, subsidiaries of Utilities Power & Light Corporation, into several independent operating divisions, each with operating authority vested in its division manager, subject to the guidance of a general manager at Dubuque, Iowa. Reduction of labor, transportation and telephone charges, as well as improvement in operating efficiency, are seen as the advantages of concentrated divisional direction.

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Scotland Grid Scheme Completed

Since the program for the standardization of frequency and the construction of the grid has now been completed in the Central Scotland area the British Central Electricity Board has notified those interested that beginning January 1 trading operations in that area will start under the provision of the 1926 act of Parliament. Under the grid scheme production of electricity in the area will be concentrated in ten selected stations.

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Receiver for Central Public Service

Pending determination of the bankruptcy proceeding recently filed for Central Public Service Corporation (ELECTRICAL WORLD, December 10, 1932, page 773), Iredell W. Iglehart has been appointed receiver for the company by Judge William C. Coleman in the United States District Court at Baltimore. The company has been given until December 14 to show cause why it should not be adjudicated a bankrupt. Active opposition to the appointment of a temporary receiver is expected on the part of the company. Progress on a readjustment program is reported.

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ETERNAL LIGHT TO HONOR MASSACHUSETTS' WAR HEROES

From the top of this 90-ft. granite shaft on the summit of Mount Greylock, highest elevation in Massachusetts, twelve 1,500-watt floodlights will throw their light in every direction as a tribute to the memory of the Bay State's warrior dead. The light, visible in five states, will also serve as a night beacon for aviators.

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Louisville Rate Action Deferred

At the suggestion of Mayor William B. Harrison legislative action on an adjustment of gas and electric rates in Louisville, Ky., will probably be deferred to permit engineering experts sufficient time to make a study of the local situation. In a message delivered last week to the Board of Aldermen he recommended postponing a new gas franchise and electric rate ordinances and retaining J. G. Wray & Company to make an investigation for the city with the purpose of establishing rates that will be fair to the Louisville Gas & Electric Company and also to the consumers.

R.C.A. Stock Goes to G.E. Holders

In accordance with the recent consent decree (ELECTRICAL WORLD, November 26, page 705) General Electric Company will distribute on February 20, 1933, to stockholders of record December 16, 1932, one share of common stock of the Radio Corporation of America for every six shares of General Electric Company common stock held, and scrip for fractional shares. General Electric holds 5,188,755 shares of Radio common and after this distribution will retain, temporarily, approximately 381,000 shares.

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California Tax Bureau Reports

That California's public utilities, particularly electric, gas and telephone companies, are undertaxed by the state in comparison with real property valuations of the counties is charged in the report of the state tax research bureau, created by the 1931 Legislature. Were the discrepancies eliminated it is estimated that state revenues would be increased by $5,800,000 a year.

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Sales Tax on Oregon Energy?

Oregon public utilities face the prospect of being called upon through taxation for further contributions to state governmental purposes (ELECTRICAL WORLD, November 19, 1932, page 675). The administration has recommended the adoption of a sales tax, which presumably would include a tax on electric energy sales, in order to relieve real property of $4,500,000 in taxes in 1933.

▼

Norfolk Votes Rate Investigation

Expressing its willingness to co-operate with the League of Virginia Municipalities in instituting proceedings before the State Corporation Commission, the Norfolk City Council has voted in favor of an investigation of electric light and power rates. The city manager was directed to communicate with the league and ascertain the attitude of other cities served by the Virginia Electric & Power Company toward bearing the expense of the investigation. The Virginia rate agitation is centering in the League of Virginia Municipalities, which is working with the American Public Utilities Bureau to effect rate reductions (ELECTRICAL WORLD, November 26, page 712, and December 3, page 744). At the hearing held in Norfolk J. G. Holtzclaw, president of the Virginia company, denied that rates are excessive and held that if the street car and bus earnings were taken into consideration the company would not be earning anything like a fair return on its investment.

Lightning Studies Aided by Surge Crest Ammeter

Remarkable simplicity has characterized many of the devices developed to give indications of voltage and current magnitudes involved in lightning discharges or the surges from impulse generators. This feature still holds for a new surge crest ammeter devised to supplant the only thing so far available for getting tower leg currents, the Lichtenberg figure recorder, which made currents inferable from voltage drop across the impedance of a portion of tower leg. The new device as described in the December *General Electric Review* is actuated by the magnetization of a cobalt-iron bar which responds to the peak of the magnetic field strength surrounding the impulse current.

At right angles to the magnetizable link is a small permanent magnet which carries a pointer deflected under the influence of the magnetic moment between the two bars. The scale is calibrated to cover the non-linear retentivity of the link and its angularity relationship with regard to the permanent magnet. The principle of action assumes that the surge is unidirectional and that the time of magnetic penetration of the link is enough shorter than the one-half microsecond rise of a (½-5) wave to leave the same residual magnetization of impulse crest as a sustained d.c. of the same magnitude would give. Placed so that the link is, say, eight or more inches from a tower leg and tangent to one of its circles of flux, the device involves no disturbance of the impulse characteristics of the tower leg path for the discharge. Increased distance from the leg gives deflection inversely proportional to the distance, thus adapting the device to a wide range of surge current crest values. Eight hundred of these low-cost devices have been placed in service this year.

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Electrical Measurements Modernize Geophysics

Emphasizing that electrical methods in geophysics are not to be confused with so-called scientific divining rods or even the time-honored ones of tradition, S. F. Kelly, consulting geologist and geophysicist, told members of the New York Electrical Society this week of some of the revolutionary techniques which have come into use in the last few years in the discovery of metals and oil. Startling accuracy and low cost are among the advantages claimed for this method.

The new science of applied geophysics involves study of electrical characteristics of the ground, observation of the earth's magnetic force, measurement of minute variations in the strength of gravity and recording of artificial earthquake effects, which are made to yield information as to the constitution of hidden parts of the earth's crust.

Striking comparisons between the new and old methods were given by Mr. Kelly. In several years following 1917 approximately 675 "wildcat" wells were put down in the Gulf Coast region oil fields, at an estimated drilling cost of $20,000,000, during which only one dome was discovered. Since the introduction of geophysical methods, about eight years ago, new oil pools aggregating 33,000,000 bbl. production have been located through the new technique. The prospecting costs have already been repaid by the oil produced and the wells are still going strong.

Electrical methods of exploration are not confined to studying ore deposits. Other types of geological information can be secured. Faced with the necessity of deciding between several possible dam sites in northern Canada a hydroelectric company found it to be too late in the season to attempt to transport expensive and cumbersome drilling apparatus into the bush. An electric survey was decided upon and the information satisfactorily obtained within a week or two.

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Hartford Again Acts for Relief

Extending its aid still further to the unemployed in the territory which it serves, Hartford Electric Light Company will furnish electrical energy without charge to the employment committee in Hartford until May, 1933 (ELECTRICAL WORLD, December 3, page 737).

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Control of Lightning Storms Sought by Viennese Engineer

Based upon the demonstrable assumption that every overhead transmission line in passing through a territory encounters definite zones of preferred lightning danger, W. Halzer, in the most recent issue of the Swiss *Bulletin des Electriciens,* offers a suggestion to force a concentration of atmospheric discharges at the point of maximum discharge probability, a point presumably where it could be arranged that least harm be done.

It would be possible, contends Mr. Halzer, to discharge large amounts of power from a zone less than a mile in radius by ionizing a path of air from the cloud to the ground, along which the discharge could take place. Based upon the known fact that flames and the gases from flames are excellent ionizers, it is suggested that specially made, powerful rockets be released within the endangered zone, to establish ionized paths for the discharge. Such rockets, filled with strontium nitrate and barium chloride, would have a rising speed of about 800 miles per hour. The rocket projectile would carry with it a thin metallic wire tail to aid the ionization.

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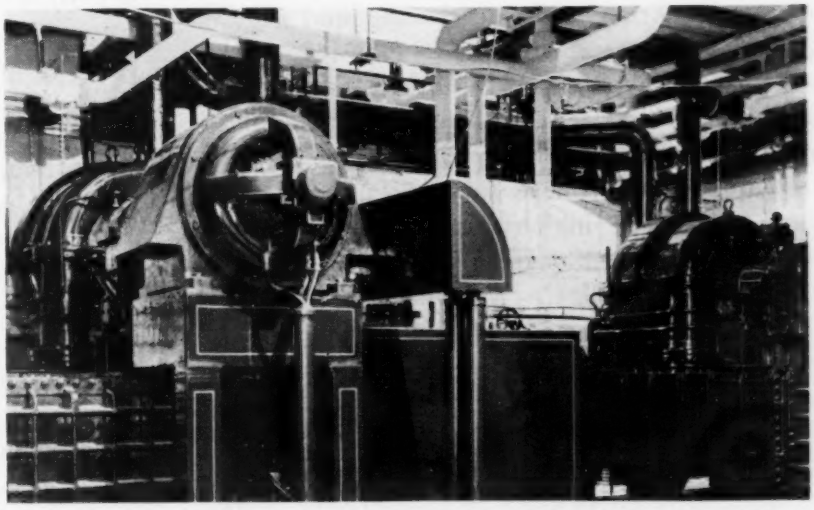
3,000 HP. FOR RADIO CITY AIR CONDITIONING



Six (250 ton capacity) refrigeration machines, of which two are illustrated, are installed as part of the air-conditioning system of the R.C.A. building, the first unit of the great Rockefeller Center in New York, to be opened officially at the end of this month. This air-conditioning equipment, totaling 3,000 hp., can offer the equivalent of 3,000,000 lb. of melting ice a day and will consume 1,350,000 kw.-hr. monthly in the summer season and 950,000 kw.-hr. monthly in the winter, it is estimated ("Electrical World," December 3, page 745).

EDITORIALS

L.W.W.MORROW
Editor

The award to Horace P. Liversidge

THE James H. McGraw medal for co-operation was presented to Horace P. Liversidge before a great company of electrical men and women in Philadelphia this week, because he is one of those rare spirits who has had the imagination, the vision, the courage and the genius to go forward and do things that should be done, where other men have failed or been afraid to try. As president of the Electrical Association of Philadelphia, backed with authority and responsibility as vice-president and general manager of the Philadelphia Electric Company system, he has made a great contribution to the progress of co-operation in the electrical industry. He has led the electrical men of that community out of discord into unity of purpose. He has established principles and policies of intelligent co-ordination and fair dealing and organized them into a practical system of teamwork. He has made the electrical business not only more profitable to dealers, contractors, wholesalers and manufacturers but has given them a healthier and happier atmosphere to work in. And all this has inspired higher standards of service, from which the public has also benefited.

But Mr. Liversidge's contribution lies not just in the things that he has done but in the fact that he has done them himself. For the greatest single obstacle to co-operation in the electrical industry today is the fact that in so many cities the chief executives of the power companies do not personally participate in co-operative work. They all believe that harmony and friendship among electrical men is a good thing both for the business and for the public. But they don't bother about it themselves. They make it the responsibility of a minor official who lacks the authority to accomplish anything. Just so, the outstanding success of organized co-operation in Philadelphia has come because Horace Liversidge has made it his business to understand the part his company should play in it and then personally to play that part. He has been able to speak for his company and to command the loyal support of its personnel in the frank policies of give and take that he has established.

Throughout the country the industry has been intensely interested in the progress that has been made in Philadelphia through co-operation. It has been deeply impressed to see the results of the enthusiastic personal leadership by the responsible operating head of the local power company. Mr. Liversidge has set an example that holds great promise.

Getting the business

MORE and more these days, when business appears to be getting on toward convalescence after its long sick spell, do we hear that products must be fitted to their markets and offer qualities whose lures buyers cannot withstand. This dictum is easy of comprehension in, for example, women's clothing, where crafty designers conjure up styles that cause the dollar bills to struggle to get out of the ladies' purses. But it holds equally well in less evanescent things as well, steel castings, for instance. Note what our esteemed contemporary *Iron Age* has to say about these very tangible things:

> In 1931 the country's ingot and castings production by electric furnaces was 1.58 per cent of the total steel output, whereas in 1930 the corresponding figure was 1.50 per cent. Both percentages compare favorably with 1.68 per cent in 1929, a record year. But the surprising expansion has been in electric steel castings. In 1929 the percentage of such castings of the total steel casting production was 26.5 per cent. As the depression deepened the demand for this product increased, until in 1930

the proportion was 27.6 per cent, expanding in 1931 to the remarkable figure of 34 per cent, a new record. That over one-third of the output of the American steel foundry industry was made last year in electric furnaces is eloquent testimony to the position which such castings have attained in the industry.

Useful Massachusetts mergers

MERGERS of small power companies in Massachusetts illustrate the possibilities of unification without impairing the benefits of decentralization. Such mergers represent a centralizing movement in corporate affairs, but the consolidation of small local properties serving towns and rural areas geographically adjacent is being effected without upsetting the centrifugal trend in management which is so desirable from the standpoint of public relations and regional development. Representative utilities under the management of the New England Power Association group, for example, include many companies which purchase energy at wholesale and retail it through villages and farm country under conditions which are common to various localities. Separate corporate structures complicate accounting, management and engineering, even when under a common general administration. The allocation of costs between companies in plant investment and running expense, interconnection and commercial development is at times troublesome and not worth the outlay which larger volumes of business justify.

A reduction in the number of corporations serving a specified region like central and western Massachusetts enables the major benefits of centralized management to be realized through district administration. Important questions of policy, whether financial, commercial or engineering, are determined at association headquarters in Boston, but a vast number of matters are handled under the direction of regional executives with economy of time and without local lost motion. A large amount of system planning and betterment work is necessary to bring many of these small properties up to modern standards of service and operating efficiency. This involves regional engineering attention as well as broader technical study by the headquarters staff. Local requirements are well understood by territorial administrations. Rates are often fairly comparable in adjacent areas and the similarity of economic conditions does not warrant the multiplication of corporate structures which originated largely from political subdivisions of territory and not from engineering or operating causes.

Regulatory authorities recognize the advantages of these small company mergers and the movement may be expected to continue for some time in the Bay State to the joint benefit of the public and the operating properties. In discussion of holding companies sight is often lost of the fact that their chief purpose is the business development of a territory and they are especially valuable in doing this for a logical economic electric power area.

Steam savings may rescue electrical load

SAVINGS claimed for local plant generation of industrial power are by no means limited to the economics of a purely electrical nature. The more steam is involved in process or heating the more the chance for the promoters of private plants to embrace steam production economies into the total which they hope will sell the engine. In other words, the engine room gets a credit that should have been earned by the boiler room and the steam-using activities. Right here, then, rests the chance for the electric utility to "get there first."

If the power company's engineer consultants can show the power user that he can make savings in the fuel and water bills, whether the engine goes in or not, at least that much will be divorced from the composite benefits otherwise attributed blindly to the engine. If the power company does not bring these points to the surface the engine company can be expected to capitalize on them. It is the part of widsom of the power salesman to render this advisory service to his clients in order that strictly electrical costs can be compared on the basis of their independent economic merits. If the power company has no steam to sell from a district system it should not overlook the opportunity to protect its electrical interests by showing industrial and commercial establishments how to keep all their outlay for energy to the point where purchased electrical power has a fair chance to prove its case against the home-made venture.

Opinions on Utility Regulation

Leaders discuss state and federal regulation. Comments on specific suggestions for improved regulation. To get full value from these discussions many readers will find it necessary to reread the address of the Wisconsin commissioner in the October 29 issue of "Electrical World."

THE address of David E. Lilienthal presented before the American Bar Association was a very tangible discussion of utility regulation. It presented facts and made suggestions.

This article was sent to several outstanding light and power executives by the editors of ELECTRICAL WORLD with a request that they frankly express their opinions on the suggestions made in the article. The editors stated that these opinions were to be used without identification of individuals or their companies. Many replies were received and each was so interesting that a selected cross-section of opinion is presented in this article. Many of the executives expressed their willingness to be identified as to name and company, but the editors believe the thoughts are best presented without identification of individuals.

In no case was there disagreement with the general principles expressed by Mr. Lilienthal and these expressions of opinion by both holding company and independent property executives indicate the breadth of thought and the receptive attitude of an intelligent group of leaders. They show that the industry is as alert as any group to conduct its affairs in the public interest. They show that most of the utility holding companies are needed and have rendered valuable and inexpensive service to individual properties.

An experienced manager of a widespread operating property

Regarding Mr. Lilienthal's article on holding companies, I have the following comments to make:

I think it was Will Rogers who said: "One good thing this depression has done is that it has eliminated the smart man." In the business world today no captain of industry or finance claims to have any corner on business brains.

The practices pointed out by Mr. Lilienthal as injurious to public interest have been brought about by bad business judgment, which apparently nearly everybody had during 1929, and is it fair to say that an elected or appointed state commission would have had better judgment than either an operating company or holding company executive?

According to Mr. Lilienthal's own statement the unfortunate overexpansion of some holding companies has in fact only slightly impaired the operating companies.

Mr. Lilienthal assumes that holding companies require practices, as far as dividends and surplus are concerned, that a local board of directors wouldn't require. This, in fact, has not been true in this state. The companies in the greatest financial difficulty here apparently are the companies which are controlled by local directors and banks and not by holding companies; they are two fairly large operating companies and two smaller ones more or less connected. All of these companies have sold a large amount of stock to their customers in the state and have passed preferred stock dividends.

This is not generally true of the operating companies which are controlled by holding companies. I am not pointing this out as a criticism of the companies named, but simply to show that it is not fair to say that a local board of directors would use better judgment than a holding company.

It seems to me, as an operating manager, that the great loss to the public has been through the sale of holding companies' securities, both utility holding companies and other holding companies, and that this might be corrected to a large extent by federal control to the extent of allowing holding companies to issue only bonds and preferred stock on physical property or on bonds or preferred stock of subsidiary companies.

I think the abuses of holding companies in regard to engineering and management contracts and purchase contracts occurred only in a comparatively small number of cases and have not amounted to much, and that these abuses are being voluntarily corrected by the holding company, and that the advances of money by subsidiary companies to holding companies is generally dangerous, but is justified under some circumstances, and these can be controlled under existing laws of most utility commissions.

It seems to me that decentralization of management is being practiced by most holding companies, and probably correctly so. This is being brought on, I believe, by the economic situation, the general public sentiment and the experience of some companies which had too centralized management over a period of years.

In conclusion, it seems to me that the present method of regulation is ample to protect the public and utility companies under normal conditions; that it can be gradually improved from time to time, but any drastic changes would be unwise; that in the next boom period, whenever it may come, it will probably be some other industry rather than utilities that will pass through such a period of overexpansion.

The president of a progressive utility

I heartily indorse the bulk of the sentiment of Mr. Lilienthal's article relative to holding companies, although I doubt whether his solution is complete. Commenting first on the six examples of clinical material:

1. This is fraud which some statute should be able to reach.

2. Improper procedure—employees should not be permitted to sell securities of another company in company

time, or urged to do so at other times. Even sale of one's own company's securities is open to serious question as a policy.

3. Bad judgment, but not confined to subsidiaries of holding companies.

4. The criterion of propriety should be the benefit to the operating company. This would involve complete disclosure of results in commission reports.

5. All contracts and arrangements between subsidiary and holding company should be subject to commission scrutiny, and not valid against commission disapproval.

6. Power should be vested in commissions to compel the accumulation of a minimum of reserve and surplus.

As a cure I would advocate:

1. Appropriate federal legislation requiring complete accounting of the operations of all holding companies of every kind and their subsidiaries in accordance with prescribed forms. This legislation to be general in the interest of the investing public, and not restricted to public utility holding companies. The information so obtained to be transmitted to insurance, bank and utility commissions in all states having supervision over any subsidiary.

2. Appropriate state legislation giving commissions authority to pass on any and all transactions between operating utilities and their controlling holding company. This to include all management, construction and purchasing contracts, as well as all intercompany loans, and with full power to void any intercompany contract or transaction, and/or to refuse to admit same in any rate case.

3. Appropriate state legislation specifically to permit commissions to interfere with the functions of management to the extent of requiring such minimum annual accrual for reserves and surplus as, subject to appeal to the courts, they may determine to be reasonable.

A veteran president of a metropolitan utility

I am glad to be able to say that I am in hearty accord with most of the opinions set forth by Mr. Lilienthal in this address. In particular, I agree with him that neither the federal government nor a state government should attempt to regulate holding companies directly, but that state commissions should be given ample authority over every transaction between the operating company and the holding company. Also, I am in full accord with him that local management can be much more effective than long-distance management, particularly in the production and maintenance of good public relations, through strong local management, and of all matters which can be handled adequately by local managers, and if long-distance management is resorted to at all, it should be in an advisory capacity only.

Some method of dealing adequately with holding companies in their relation with operating companies seems absolutely necessary, both for maintaining a profitable growth of operating companies and to restore, if possible, the confidence of the investing public in holding companies.

An enterprising president of a transmission utility

May I take up in order the points raised in Mr. Lilienthal's address:

First—An operating utility issued and sold a large amount of short-term notes. . . . I do not believe that a holding company should ever borrow from an operating company. I feel that the commission in this case was very liberal.

Second—In my judgment, no holding company should offer its stock, under the guise of customer ownership, to the customers of an operating company. Only the preferred stock—and by this I mean first preferred—should be offered under the customer-ownership plan. The company was, in my judgment, wholly wrong, and I am in sympathy with Mr. Lilienthal's criticism.

Third—Both the holding and the operating company were wrong in this instance and their conduct cannot be defended.

Fourth—Both the holding company and the operating company were wrong in their practices; there is no defense; Mr. Lilienthal's criticism is just.

Fifth—The information should have been furnished to the commission.

There is no defense for a holding company that bleeds its operating companies. If a holding company cannot show a distinct service, of which the public is the beneficiary, it has no right to existence. I am in favor of the regulation of holding companies, both as to security issues and as to practices. I believe this regulation should be by the national government. I believe such regulation will operate to the benefit of reputable holding companies and will prevent many of the fiascos that have been the result of poorly planned and poorly managed fly-by-night concerns. Many of the concerns that have drawn down the greatest criticism of holding companies are managed by brigands in disguise. These men have no right to call themselves business men.

On the whole, I think Mr. Lilienthal's criticisms are right, very timely, and that his conclusions are justified by the facts.

An experienced president of a metropolitan property

My one fault found with the address is that while Mr. Lilienthal recognizes the differences in practice between managements, whether these be of holding companies or operating companies, he has missed the chance to do a good deed in that he failed to impress on his audience the fact that there is no solidarity of our industry—that we are a bunch of cranky individualists who can seldom agree on any issue.

Several years ago I discussed a case of a hypothetical holding company, some of whose properties had been able to accumulate creditable reserves, and raised the question as to whether the pooling of reserve funds was permissible; also, the further question if it was ethical for the holding company to issue its notes, debentures or other obligations in exchange for cash of the one property and thereafter to lend the money so obtained to another property at a higher rate of interest. I pointed out that there was a question of trusteeship, and that the collection of a replacement fund or any other reserve from the consumers of one company ought to be looked upon as a trust. My conclusion was that if such practices as I had described existed, or ever did exist, they were unethical. Continuing from this conclusion, I referred to the case of Slaymaker vs. Columbus Railway, Power & Light, in which case court after court had held that a controlling holding company was bound to do equity because it was in control; in brief, that in such a case the holding company is burdened with the status of a trustee. The case called for an accounting with minority

stockholders, but the decision seemed to be very broad. I continued further as follows: "The position of the holding company today is getting to require a very exact definition and very exact observance of not merely the law but the ethics, and those holding companies which have wisely restricted their dealings with their subsidiaries or controlled properties, first to the receiving of a reasonable or liberal return for money invested and, secondly, to the repayment to them of expense incurred, or payment to them for specified service actually rendered and billed, are going to be in the happy position of not being subject to challenge; while those others whose relations are covered by a bunched amount of so much percentage of gross earnings, or other figures of that kind, are going to be required to go into details and give a trustee's accounting."

A transmission utility president says

In a great many of the points covered I think he is right, but, on the other hand, neither the commissions of the various states nor the federal government should undertake to put the blame for all the effects of the depression onto the holding companies.

A metropolitan utility president agrees

I am glad to have read the abstract, since it reveals a point of view which I had not assumed properly attributable to the commissioner. His whole treatment seems to me to be a calm, fair and judicious development of a difficult subject. I could go along with it quite completely.

An experienced executive of a large utility

The proposal of Mr. Lilienthal that the state commissions should be "given ample authority over every transaction between the operating company and the holding company" seems to me to be essentially in accord with views that I have long held upon this subject. I can see no reason whatever for federal regulation of the holding company if this authority is given to the state commissions. In my opinion, the public interest will be much better protected by state regulation over the transactions between the operating company and the holding company than by attempting federal regulation over such transactions. The overlapping authority involved in giving to a federal bureau or commission authority to regulate these transactions would be injurious, rather than helpful, to all interests involved. It also seems clear to me that state commission authority over transactions between holding and operating company is essential to full regulatory authority on the part of the state body. If such authority is given to the state commissions, there is no occasion for federal interference in this field of regulation.

I am also in agreement with Mr. Lilienthal as to the desirability of granting greater autonomy to the managers of the operating companies who are local citizens and should be more capable of passing upon local problems than the head office of the holding company if that office is located in some state other than the state of the operating company.

In general, therefore, I should say that Mr. Lilienthal's views are sound and well reasoned. The important point to my mind is that electric service and electric rates are essentially local problems and the electric utility should be an intimate part of the community which it serves. Hence its control, both managerial and regulatory, should be local. The real interests of the electric utility and the community are not antagonistic, and any measures which will promote a better mutual understanding between the utility and the public which it serves will be to the advantage of both.

Commendation from the president of a large utility

In more than twenty years of experience in being connected with one of the so-called holding companies I have not seen in practice any of the policies that Mr. Lilienthal enumerates critically:

1. I do not believe that a holding company or management company or parent company, whatever you may call it, should derive any benefits from its subsidiaries, from money that would be loaned by the operating company to the holding company. In the company with which I have been connected it has been not only a rule, but practically a statute, that the funds of the subsidiary would in no way be used by the parent company.

2. I have never known of an instance where the holding company with which I have dealt has ever profited to the amount of even a dime in purchases that it has made for its subsidiaries, or for construction work which it has done for such companies.

3. The employees of the subsidiary companies have never been requested, nor has it been even suggested, that they sell stock of the parent company. They have, of course, sold preferred stock of their own operating companies to the public, which in every instance has been beneficial to it, and all the time the public has held it the company has been in a very strong financial condition in every respect.

Looking on this subject more constructively, I might say that during my twenty-odd years' experience with a holding company I can say most emphatically that its services have been valuable to the subsidiary far in excess of the reasonable compensation it has received for supervision services.

1. This particular holding company has purchased machinery, apparatus and materials for its subsidiaries—however, only those that could not be bought advantageously locally—and in every instance these purchases have been made on a much more advantageous basis than would have been the case had the purchase been made by a single company. In fact, the difference between the price for which they could have been purchased by a single company and the price they did obtain in itself either paid entirely or practically all of the supervision charges. I should state that the holding company has given the operating company all of the benefits derived from such purchases that it made, and the holding company did not receive any commission.

2. The general operating, engineering, commercial, accounting, legal and other information that has been given to the subsidiaries has been of great value and has been reflected in more efficient operation, better and lower-priced construction work, which has been of large value to the stockholders of the company, and to the public through the service which it has received and the charges for electric service.

3. The construction work that has been done by one of the subsidiaries of the holding company has been of a major nature, and in every instance the job has been completed with not a single hitch, and the operating re-

sults have been practically perfect. The cost of this engineering and construction work has been considered less than could have been obtained from consulting engineering firms and contractors.

4. The parent company has arranged for financing in good and bad times, on bases that have first made it possible for the company to float bonds and preferred stocks, and, second, they have sold at higher figures and lower rates of interest and dividends than they could have been sold had the company been operating as a single unit, or been connected with a holding company that did not have a good reputation or was small in size.

I could go on and enumerate many other valuable advantages that a well-managed holding company can and does give to its subsidiaries, but I think it is unnecessary to burden you with this detail.

I wish to conclude by saying that I can prove every contention that I have made, and more too, by giving numerous practical illustrations, and I also wish to add that I have been conscientious in everything I have said.

A metropolitan president urges action

I think Mr. Lilienthal shows a wonderful grasp of this whole subject and that it is important for the entire electrical industry that some, if not all, of his ideas should be incorporated in the laws of our various states, so that our local public service commissions might have the authority he deems necessary. If these ideas of Mr. Lilienthal were carried out I believe there would be no necessity for federal regulation.

I might say in connection with this particular company that we operate almost entirely along the lines suggested by Mr. Lilienthal in connection with not only our relations with the public but our relations with the holding company. First, we have no contracts for managerial service of any kind. We are a self-contained organization and only call on the holding company or outside concerns to furnish that service which in the ordinary course of events is not continually recurring, such as engineering service in connection with large power houses and generating stations. Second, in regard to the matter of purchases, this service for economical reasons can best be handled by one group purchasing for several companies. For this service, however, we pay less than it cost us originally to maintain our own purchasing department.

In all of our contacts with the public our officers and division or district managers have very complete authority to act on their own initiative on any questions arising between our customers and the company. They are encouraged to make use of this authority so that we are able to avoid as much as possible the ideas of too much centralization or lack of authority among our local men. It has been our experience that this has been very helpful to both the company and our men in their respective communities.

▼ ▼ ▼

Switch Operation Records Pay Their Keep

Reduction of automatic breaker operations per year of about two-thirds and reduction also of breaker lockouts in about the same ratio are the benefits collected by the Wisconsin Gas & Electric Company (Racine) from keeping a close record of breaker operations on its 65 rural line feeders. Complete data are presented in the accompanying table. Regularly each month each division receives a copy of the current operating record and this serves as an incentive to improve maintenance and keep a sharper eye on conditions that might cause trouble if uncorrected. Employees watch the lines continuously as they travel along the country roads because the operating record has shown them in black and white that a lot of uncomfortable emergency work at night in rain and snow can thus be avoided.

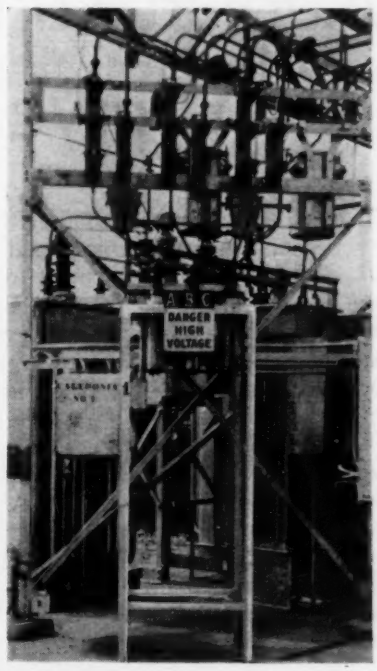
The use of automatic reclosing breakers on rural lines is not widespread. But it undoubtedly will become more common as more utilities realize, as did the Wisconsin Gas & Electric Company about five years ago, that country folk become as exasperated as city people do if the juice goes off and they can't get Amos and Andy on the radio. But the prospect of equipping some eighty feeders with breakers costing about $1,300 apiece was not inviting from an investment standpoint. No direct increase in earnings could be looked for and decrease in operating expense would be small. The problem found solution in a low-cost automatic breaker available at about half the price above noted. As the table shows, the work of equipping the lines has gone along steadily and it is expected that all rural lines will have this modern service feature in 1933.

Table of Rural-Line Automatic Breaker Operations

	1930	1931	1932 (8 months)
1. Breakers in service	50	55	65
2. Automatic operations	1,564	1,915	644
3. Lockouts	100	132	47
4. Lockouts per breaker per year (3 ÷ 1)	2	2.4	(est.) 1
5. Operations per breaker per year (2 ÷ 1)	31	35	(est.) 13
6. Operations per lockout (2 ÷ 3)	15.6	14.5	13.7
7. Fault cleared without lockout in per cent of fault occurrence*	93	92	92

*Formula for calculating per cent of clearances without lockouts:

$$\frac{\text{Total operations} - (3 \times \text{Lockouts})}{\text{Total operations} - (2 \times \text{Lockouts})} = \text{per cent}$$



Automatic reclosing breaker for rural service

Practically all rural customers of the Wisconsin Gas & Electric Company have service comparable to urban supply through the use of breakers like this one furnished by the Automatic Switch Company.

Ryburg - Schweerstadt power station, rated at 140,000 kw., is jointly owned by two German and two Swiss partners. Four 32,500-kw. generators serve through individual four-winding transformers four systems of different voltage.

By
PAUL R. SIDLER
Brown Boveri & Company Ltd.

Kaplan Turbines on Rhine Serve Systems at Three Voltages

IN THE upper part of the Rhine where it forms the border between Germany and Switzerland one hydroelectric power development follows the other, dividing the river in a number of consecutive water levels, which are readily available for navigation. The most recent and at the same time the most powerful of the stations on the Rhine is Ryburg-Schwoerstadt, located about 14 miles above Basle.

Ryburg-Schwoerstadt is jointly owned by two German and two Swiss partners and every one is at all times entitled to one-fourth of the power which can be generated, even in the case of disturbance at one or the other machine. Considering further that the power has to be transmitted into systems with different voltage, it will easily be understood why the interest of European engineers has been focused on this development in past years and why they are now watching with keen attention the operating results obtained under rather unusual conditions.

A normal water flow of about 35,000 cu.ft. per second is obtained in the average year for about 183 days. Hence, the four turbines of the power house are designed for a mean quantity of water of 8,750 cu.ft. per second with an output of 35,000 hp. at a head of about 33 ft. During periods of low water the total output of the four units decreases to about 50,000 hp. With full utilization of the generating capacity and during years of normal water flow the yearly production of the station amounts to 600,000,000 kw.-hr. No reserve unit has been provided, but the turbines are able to handle continuously an overload of 20 per cent above the mean rated capacity. In the case of one unit being out of service the remaining three will thus utilize up to 90 per cent of the available water flow.

The dam has a total length of 335 ft. between the bulkheads, with four double-leaf gates, each of 73 ft. clear span. The two leaves of each gate are provided with separate remote-controlled and interlocked hoisting devices located in an operating bridge across the whole length of the dam. The emergency gates are handled by a 75-ton gantry crane.

The four Kaplan turbines are believed to be the largest so far in operation. Since considerable development and research work had to be performed before obtaining the definite design, a co-operative association of three leading turbine builders was formed for this occasion, the members being J. M. Voith, Heidenheim (Germany), Escher-Wyss & Company, Zurich, and Ateliers de Charmilles, Geneva. The work was distributed in such a way that about half of the labor and material was supplied from Germany and half from Switzerland. A similar policy was established for the whole construction work, including the supply of the electrical material.

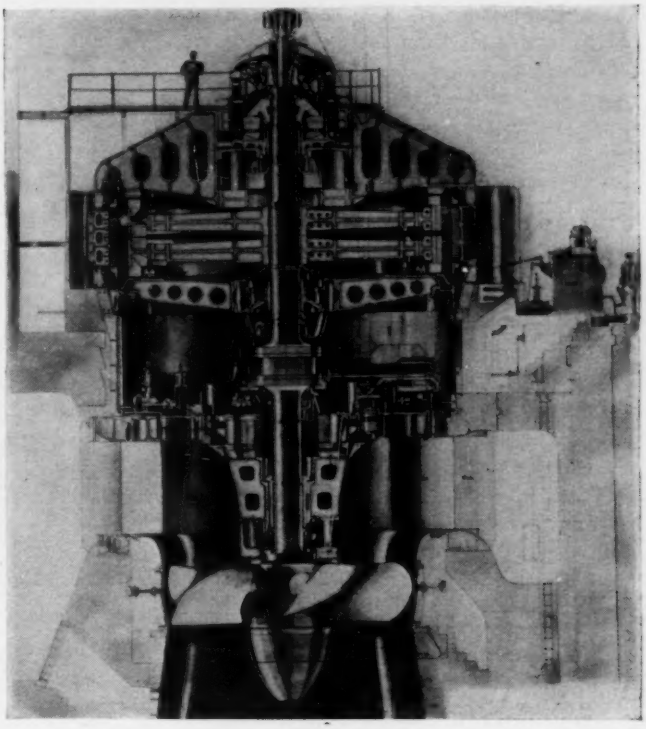
Separate oil-pressure governing systems have been provided to operate the regulating gates and adjust the

runner blades. The rotating oil servo-motor, controlling the runner blades, is located between the flanges of the turbine and the generator shaft. The two governors of one turbine are so designed that the load can be practically shut off by either one of them. Manual control with a separate pressure oil system comes into operation should both automatic governors fail. Extensive acceptance tests and operating results have shown that all parts of the governing system work satisfactorily and that the increase in speed resulting from a sudden shut-off of various loads remains considerably below the guaranteed figures.

One of the most important elements in vertical turbo-generator sets is the thrust bearing, carrying the total weight of the turbine runner and the rotor of the generator, together with the hydraulic thrust on the turbine blades. In fact, in many quarters the thrust bearing has been looked upon for years as the main factor which limits the size of vertical hydro-electrical machine sets. The segmental thrust bearing, developed by Brown Boveri more than a decade ago, has proved its reliability in a great many installations of various sizes and speeds. This construction has been adopted for Ryburg-Schwoerstadt where a total load of 900 metric tons has to be carried.

The generators were built in the Baden, Switzerland, and Mannheim, Germany, workshops of Brown Boveri & Company. They are designed for a rated output of 32,500 kva. at 70 per cent power factor, 10,500 volts, 50 cycles, 75 r.p.m. with a continuous overload capacity of 35,000 kva. Some dimensions and weights of these machines, which rank among the biggest ever built, may be of interest.

Weight of complete generator with accessories (metric tons)			565
Weight of rotor (metric tons)			260
Bore of stator (feet and inches)			28–6
Over-all width of stator (feet)			41
Height above machine room floor (feet and inches)			26–9
Measured efficiency of generator			
At power factor	1.00	0.8	0.7
Full load (32,500 kva.)	97.9	97.2	96.7

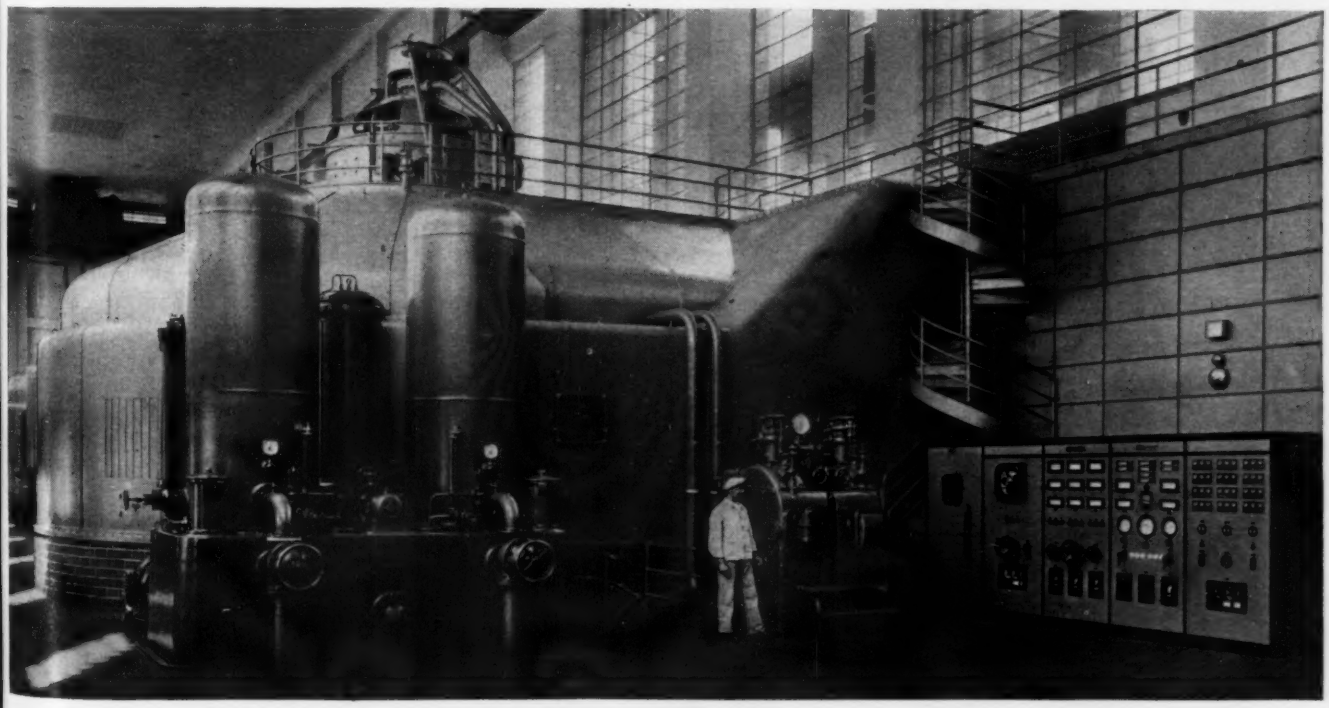


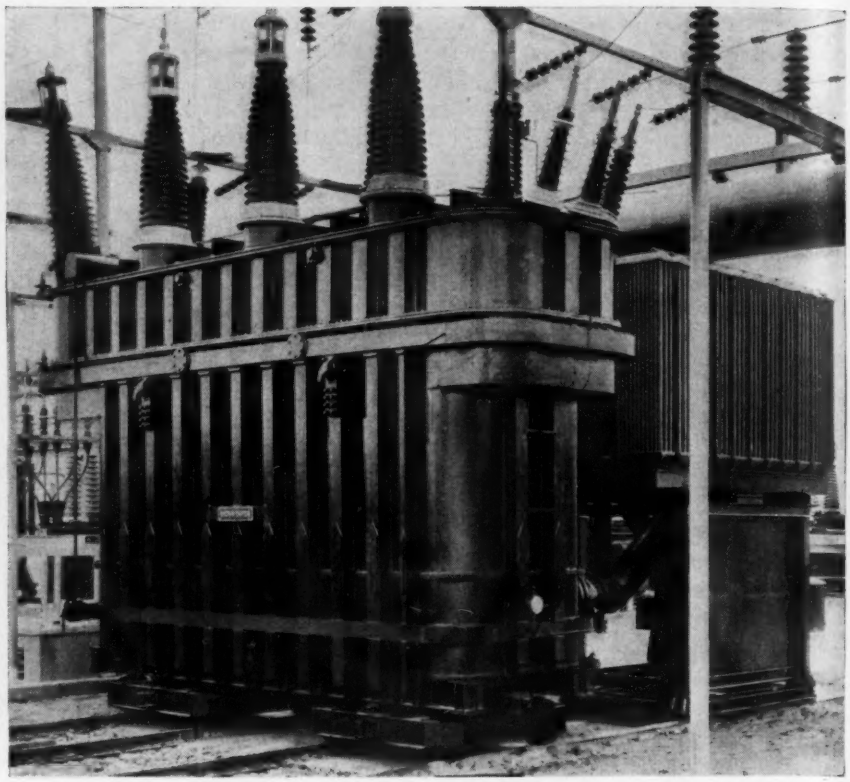
Section through adjustable-blade Kaplan turbine unit

The regulating and protective equipment includes quick-acting voltage regulators of the well-known rocking contact type, differential relays for protection against short circuits in the windings, maximum-current and maximum-voltage relays, temperature indicators, oil-flow meters, ground detector equipment and a CO_2 fire-extinguishing system.

The machine voltage of 10,500 is stepped up by three-

One of the four 32,500-kva., 10,500-volt, 75-r.p.m. hydro units



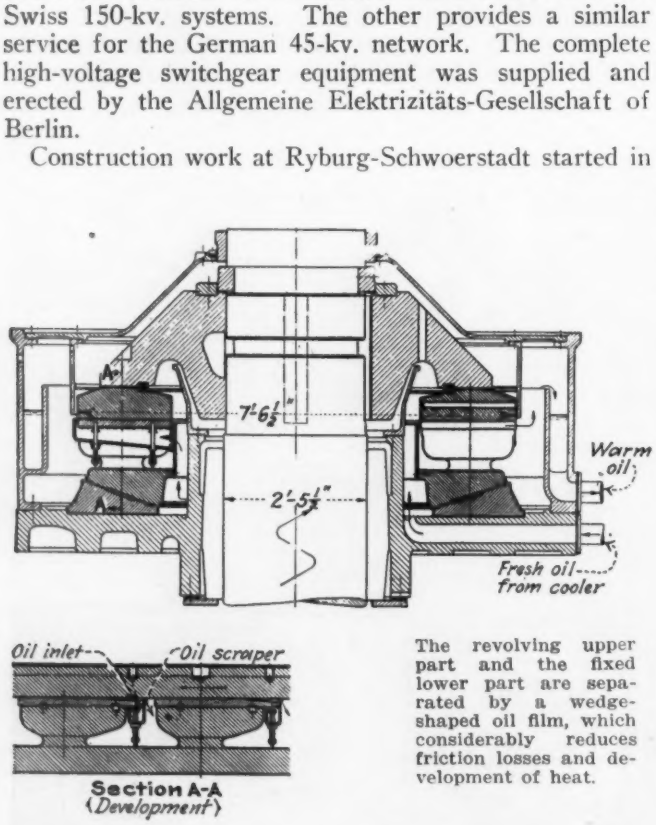


Three-phase, four-winding transformer with separately mounted oil cooler
Rated at 32,500 kva., 10.5/45/125/150-kv.

phase, four-winding transformers (one for each generator) to the three different transmission voltages of 45 kv. and 125 kv. for the two German partners and 150 kv. for the two Swiss partners. These four-winding transformers, equipped with oil coolers, were furnished by Brown Boveri and the Machinenfabrik Oerlikon, two each. The different voltage requirements and the provision that the available energy must be at all times equally distributed between the four partners resulted in a switching plant of unusual extent. In the present stage double busbars for every high voltage and two outgoing lines for every partner have been installed. However, provisions have been made for thirteen outgoing lines and addition of two frequency-changer sets and their transformers which may be needed so that there will be a satisfactory transfer of energy between the four systems which are interconnected at this station.

Two regulating transformers with tap changing under load are included in the present layout. One of these transformers will be used for transfer of energy between the German 125-kv. network and one of the two Swiss 150-kv. systems. The other provides a similar service for the German 45-kv. network. The complete high-voltage switchgear equipment was supplied and erected by the Allgemeine Elektrizitäts-Gesellschaft of Berlin.

Construction work at Ryburg-Schwoerstadt started in the spring of 1927. The first machine set went into operation in the latter part of October, 1930, and since August 23, 1931, the whole plant has been in normal service. In spite of the many complications arising from the particular set-up of this power development, operating results so far have shown that the great expectations of engineers and economists have been completely fulfilled.



The revolving upper part and the fixed lower part are separated by a wedge-shaped oil film, which considerably reduces friction losses and development of heat.

Segmental thrust bearing that supports 900 metric tons

▼

Energy Use— a Gage of Industry

In the ELECTRICAL WORLD of November 19 the statement was made that for the first time since 1927 the index of industrial activity was higher in October than in September. There had previously been a considerable increase in September over August. The statement was based on reports of electrical energy consumption in manufacturing plants. While referring to the country as a whole, it also applied specifically to the Middle West, as was evident from a table included in the article.

From a Milwaukee banking house there was received, some days later, a published statement to the effect that there had been an improvement in factory employment conditions from August to October, the first that has occurred in a similar period since 1928. It was based on employment reports by the Industrial Commission of Wisconsin.

This is not a mere coincidence. It only shows, once again, that electrical energy consumption is a prompt and reliable indicator of industrial activity. Index numbers have run closely parallel with statistics on employment and production. Frequently, especially for certain fields of industry, they are the first gage of activity to become available.

Rural Electrification Rates and Policies

By BEN H. NICHOLS
Oregon State College, Corvallis, Ore.

This survey of rate schedules, returns and investment data pertinent to rural load building discloses current methods by which the utilities are improving the value of their services to that large potential consumer, the farmer

EARLY investigations of the engineering phases of serving farm loads disclosed that future expansion in rural areas depended upon the reduction of the total amount of fixed charges on the large investment in lines and equipment per customer and the necessity for maximum use of electrical energy to reduce the fixed charge per unit.

To meet conditions imposed by the first limitation, the utilities have resorted to the most inexpensive construction which is consistent with adequate safety, good service and reasonable maintenance costs. Even with this practice fixed charges on the investment have been found to be excessive, and in some instances it has been necessary to charge the consumers with a portion of the first cost of the line. Because of the controversial nature of this practice regulatory bodies have investigated the rural service field and many have issued orders on this subject. Naturally wide variations will be found both in the methods employed by the utility in reducing the fixed costs of rural extensions and in the degree of supervision exercised by the regulatory bodies.

As regards the second factor, maximum use of electricity primarily depends upon a favorable rate schedule which will promote application of electrical energy on a sound, economical basis. In ordinary practice utilities require a minimum guarantee of either connected load or energy consumption before constructing the line. This is another controversial point for official regulatory scrutiny.

Rural rates in the United States

In view of the wide divergence in operating practice relative to extension policies and rural rate schedules, a review of existing methods and regulations should be of assistance in guiding future developments. To make the investigation as comprehensive and valuable as possible, data were secured from authoritative sources in each state. Information has been segregated into the two groups by which a ready comparison between conditions in various sections of the country could be made. The first grouping was on the basis of the size of the utility, each group being further broken down on the geographical basis shown in Table I. States included in each group are considered to have agricultural and climatic conditions sufficiently alike for the purpose of this investigation.

Rates were investigated from two angles, cost per kilowatt-hour and the type of schedule. Using the various rate schedules which were secured, bills were computed for conditions as assumed in Table II, values for which are results of studying the energy consumption of a number of representative farms.

From these calculations the average unit cost of energy for different consumptions were obtained and comparisons were made on this basis. Average energy costs for each assumed load are tabulated in Table III for the large, medium and small companies in each geographical area.

For large utilities the Pacific Slope has the lowest rates, with the Great Lakes, Middle Atlantic and North Atlantic areas forming a group having reasonable costs for energy. In the former area favorable hydro developments, intensified agriculture and irrigation contribute to low rates, while in the latter well-diversified farming and high living standards are factors influencing rates favorably. On the plains and in the South higher costs prevail, load building, which is essential for low rates, being retarded in the former by large farms with little diversified agriculture and in the latter by the low cost of colored labor. Similar comparisons may be made from Table III for the medium- and small-sized companies.

Table IV summarizes the average cost for the large, medium and small companies and shows that for loads above 100 kw.-hr. per month the large companies have consistently lower rates for all values of consumption. One point very forcibly brought out in this table is the fact that rate comparisons between different localities are valueless as a basis for determining how such rates should be adjusted. Results may show trends, but should not be used for conclusive determinations. These rural rates are not considered excessive by those associated with rural development in various states. Upon direct query, authorities expressed opinions that the high average costs for low consumptions retarded load building,

Table I—Geographical Classification of States

Pacific Slope	Washington, Oregon, Idaho, California
Mountain Plateau	Montana, Wyoming, Colorado, Utah, Nevada, Arizona, New Mexico
Great Lakes	Wisconsin, Iowa, Missouri, Illinois, Michigan,
Plains	Texas, Oklahoma, Kansas, Nebraska, South Dakota, North Dakota, Minnesota
Great Lakes	Wisconsin, Iowa, Missouri, Illinois, Michigan, Indiana, Ohio, Kentucky
South	Tennessee, Arkansas, Louisiana, Mississippi, Alabama, Florida, Georgia, South Carolina, North Carolina, Virginia
Middle Atlantic	West Virginia, Maryland, Delaware, Pennsylvania, New Jersey, New York
North Atlantic	Massachusetts, Connecticut, Rhode Island, Vermont, New Hampshire, Maine

pointing out that the farmer could not afford to use energy for lighting unless his consumption for other uses was high.

Rural rate schedules

Four types of rates were found to be in general use for rural service in the United States, namely, the straight, the block, the Wright and the Hopkinson. Flat-rate metering was limited to a few cases of controlled service. In Table V are tabulated the schedules as used by the large, medium and small companies, together with pertinent data on their application. As revealed therein, a predominant number of companies use the one-meter rate, 62 out of 77 using it exclusively. Most of the one-meter rates are of the Hopkinson type, although there is a distinct tendency to change to the block type of rate as the size of the utility decreases.

In the larger companies demand rates are shown to be based upon transformer sizes, customers per mile or total load. Smaller companies did not use demand rates sufficiently to observe their tendencies. Interesting is the noticeable trend toward a decreasing use of either penalty or discount clauses as the size of the company decreases.

For multi-meter rates there is a general tendency to have one rate for lighting and cooking and a second rate for power. Power schedules are generally of the Wright demand type, lighting and cooking loads being metered with a block schedule. Of particular interest is the apparent tendency of multi-meter rates to produce higher costs than those of the one-meter rate schedule.

Among the larger companies using the single-meter rates there seems to be a decided preference for the Hopkinson demand rate, 75 per cent of those reporting using this schedule. Investigation revealed that territories where this rate predominated (the plains and South) rates were higher than in other sections. This is to be expected as the high demand charges of this type of rate structure would make for high unit costs of energy at low values of consumption. With this type of rate, demand is usually based upon transformer size or customers per mile, or both, and is usually fixed to insure a return equal to the fixed costs of the line regardless of the amount of energy used. This type of rate tends to discourage use when the consumption is low, the effect of its high demand charges being still felt with increased use.

Lowest unit costs of energy were produced by the

Table II—Conditions Assumed for Obtaining the Average Cost of Energy from Rural Electric Rate Schedules

Total kilowatt-hours	25	75	150	300	500	750	1,000
Lighting and small appliances	25	35	35	60	100	125	150
Cooking and water heating	....	....	75	150	250	325	450
Power	....	40	40	90	150	300	400
Rooms wired							
House	5	6	6	7	8	9	10
Other buildings	1	1	1	2	3	3	4
Square feet of house wired	1,000	1,500	1,500	1,750	2,000	2,500	3,000
Connected lamp load							
House, watts	400	500	500	600	700	800	1,000
Barn, watts	60	100	100	200	300	300	400
Total hp. motors	0	2.0	2.0	4.0	5.0	7.5	10.0
Range kilowatts	0	0	3.5	6.0	7.0	8.5	10.0
Transformer kva	1.5	1.5	3.0	5.0	5.0	7.5	7.5

Table III—Variation of Average Energy Cost With Load for Different Geographical Areas

Region	No. of Cos.	Cost per Kw.-Hr. in Cents						
Large Companies								
Kw.-Hr. per Month		25	75	150	300	500	750	1,000
Pacific Slope	5	11.10	5.19	4.13	3.27	2.79	2.82	2.70
Mountain Plateau	1	8.48	8.16	5.93	4.42	4.17	4.28	4.14
Plains	7	22.51	9.91	7.09	5.41	4.51	4.16	3.92
Great Lakes	13	24.67	9.46	5.72	4.58	3.99	3.89	3.74
South	8	20.51	10.28	7.19	5.38	4.41	4.44	4.33
Middle Atlantic	6	14.97	8.11	5.32	4.66	4.20	4.00	3.85
North Atlantic	3	19.10	8.21	5.80	4.62	3.89	3.62	3.49
United States — Average	43	19.85	8.88	5.93	4.72	4.04	3.91	3.77
Medium Companies								
Pacific Slope	3	11.12	8.41	6.69	5.26	4.06	3.83	3.59
Mountain Plateau	4	13.40	8.66	6.03	5.16	4.68	4.50	4.30
Plains	4	18.75	9.17	6.53	5.06	4.34	4.08	3.87
Great Lakes	2	18.50	9.50	6.92	5.29	4.38	4.07	3.80
South	2	21.70	10.87	7.27	5.25	4.47	4.04	3.89
Middle Atlantic	4	9.03	6.83	4.79	4.34	3.95	3.93	3.81
North Atlantic	2	16.72	7.32	4.71	3.49	3.13	2.95	2.86
United States — Average	21	15.24	8.53	6.06	4.86	4.19	3.98	3.80
Small Companies								
Pacific Slope	2	9.80	5.00	3.83	2.79	2.38	1.91	1.74
Mountain Plateau	1	14.09	10.09	8.54	7.97	7.58	6.73	6.29
Plains	1	17.00	9.00	8.37	5.06	4.54	4.28	4.15
Great Lakes	3	16.07	8.58	6.39	4.99	4.29	3.94	3.76
South	0	....	....	....	....	....	....	....
Middle Atlantic	2	17.00	9.09	7.56	7.17	6.00	5.89	6.84
North Atlantic	4	10.62	8.31	6.60	6.00	5.76	5.34	5.12
United States — Average	13	13.49	8.17	6.40	5.53	4.98	4.60	4.41

Table IV—Comparison of Average Energy Cost for Different-Sized Companies

In Cents per Kilowatt-Hour

Kilowatt-hours	25	75	150	300	500	750	1,000
Large	19.85	8.88	5.93	4.72	4.04	3.91	3.77
Medium	15.24	8.53	6.06	4.86	4.19	3.98	3.80
Small	13.49	8.17	6.40	5.53	4.98	4.60	4.41

Table V—Comparison of Types of Rate Schedules for Different-Sized Companies

Classification	Companies	One-meter Rates	Multi-meter Rates	Type of Rate: Flat	Straight	Block	Wright	Hopkinson	Basis of Demand Rate: Transformer Rating	Area of Rooms	Length of Line	Cost per Mile	Motor Load Only	Total Load	Discount: Discount	Penalty	None
One-meter																	
Large	43	34	..	..	..	7	3	24	12½	1½	1½	5	3	3½	13	11	10
Medium	21	17	..	..	..	7	1½	8½	7	1½	*	..	..	1	6	1	10
Small	13	11	..	..	..	7	1	3	1	2	..	..	..	1	½	2½	8
Totals	77	62	..	..	..	21	5½	35½	20½	5	1½	5	3	5½	19½	14½	28
Multi-meter																	
Large	9	..	23	1	..	13	7	2	...	2	..	..	7	..	8	9	6
Medium	4	..	12	2	1	7	..	2	...	..	..	..	2	..	2	1	9
Small	2	..	5	..	2	3	...	...	...	..	..	..	..	..	...	...	5
Totals	15	..	40	3	3	23	7	4	...	2	..	..	9	..	10	10	20

*Customers per transformer — ½.

block-type rate with a service charge. As the service charge was much less than the fixed charge element of the Hopkinson rate the cost for small consumption was low, and since the blocks decreased the unit costs of energy for higher consumption, the general over-all effect of this rate was to produce the lowest cost of energy for the consumer. Wright demand rates produced a reasonably low cost for low value of consumption, the higher consumption costs being due to charges for energy in the final block.

Of the larger companies using both multi-meter rates, eight used the two-meter and one a three-meter rate. Where a demand rate was used it was based only on the motor load, and of these nine companies, twenty-three schedules were used, a decided preference being shown the block rate for all uses except power, for which the Wright demand rate found the most favor. Costs produced by the one-meter rates were, in general, lower than those produced by the multi-meter rates of other companies in the same area.

Among the larger companies there were twenty-one rate schedules with discount clauses, twenty with penalty clauses and sixteen with neither, a majority believing in some inducement, but being divided as to the form it should take.

Among the twenty-one medium-size companies whose schedules were available, seventeen had the one-meter, two had two-meter and two had three-meter rates. Preference for one particular type of rate is not so apparent in this group, although where the Hopkinson rate was used to any great extent energy costs were among the highest. As before, block-type rates produced the lowest energy costs. Where the multi-meter rate was used in this group power costs were lower than with the one-meter rate in the same area; exactly the reverse situation of the larger companies. This may be due in part to a tendency for the use of block or Hopkinson rates instead of the Wright demand rates for power schedules.

Authorities differ as to the type of rate schedule most suitable for rural service. Many feel that the demand type of rate imposes undue cost on the consumer of small amounts of energy, thus hindering load building on the farm. Others express the belief that rural rates should be essentially the same as those for urban customers, corrected, of course, for the additional investment needed for the service. Minimum annual guarantees have been given considerable emphasis, this element being most often included in block rate schedules and acting to increase use, with consequent lower cost per unit to the consumer. With the Hopkinson form of rate the minimum guarantee is included in the demand charge.

Although there are many divergent opinions, it seems logical to conclude that the demand rates should not be based upon arbitrary assumptions, but on the actual measured demand. Here the difficulty lies in the cost of installation and maintenance of an additional meter. In the interest of simplification, a rural rate should be based upon a single schedule. This schedule should contain two elements, a demand charge, based upon the actual measured demand and applied only to the cost of the rural distribution system, and a low energy rate without any blocks or steps. The demand charge would take care of the fixed charges of the investment necessary to serve rural load with yearly adjustments made to take care of added customers. The charge for energy consumed should be equal to the average cost of generating and transmitting the power to the point of connection with the rural distribution system, plus the operating cost within the rural system itself.

Aside from the simplicity of such a rate, it would be eminently fair to the consumer, and the low energy rate would encourage the use of electricity, thereby improving the diversity, which would compensate for the poor load factor of the farm load. The need for improved rural rate schedules is apparent from a study of the accompanying tables, and while this proposal is not ideal and might need modification in certain instances, it is a sound basis upon which to approach this important subject.

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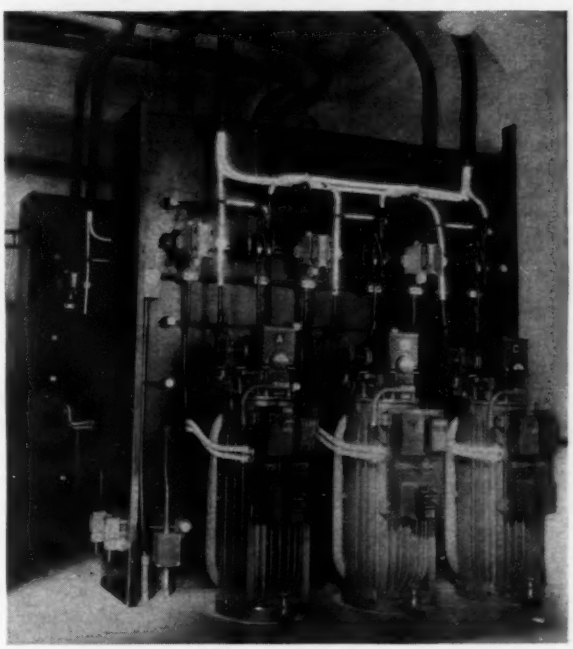
Economy and Accessibility in Regulator Connections



Two steel partitions projecting at right angles from the wall of the Vallejo, Cal., substation provide the effect of four bays, in each of which three single-phase regulators for each feeder are placed. Either side of each partition thus provides a surface for mounting necessary instruments and wiring, certain circuits being carried in conduit and others in insulated cable. Instrument transformers are fastened to a raised, horizontal angle iron strap and the main leads are supported on two strap iron brackets.

Another interesting deviation from the usual practice consists of using asbestos-covered cable pulled in fiber conduit for the main leads between the switchboard cubicles and regulator banks. By using exposed runs with the conduit bolted to metal channels fastened to ceiling cross-beams, flexibility with low installation costs is obtained. In appearance and economy, this installation of the Vallejo Electric Light & Power Company compares favorably with the more elaborate and more expensive construction commonly used for this class of substation.

New Reactors Limit Voltage Rise on Network Cables

By C. A. WOODROW

Central Station Engineering Department, General Electric Company, Schenectady, N. Y.

CHARGING kva. of a feeder cable supplying a low-voltage network may not be negligible in comparison with the reactance of the network and its transformers. The relative magnitudes may even be such as to create a series resonance condition during the interval while the network protector is opening under the influence of reverse magnetizing current flow to a feeder on which the breakers have opened at the station. Lamp voltages rise with risk of burnout and the relay problem in general is complicated.

The General Electric Company, tackling such problems arising on the Buffalo and Brooklyn networks, has developed a shielded five-legged core reactor which has gaps in the supplementary cores calculated to give the device triple functions. It serves as a capacitance compensator or shunt reactor, a grounding transformer and a loss-control device under conditions of line-to-ground fault on the feeder. Rise in voltage and charging current under feed back to the grounded cable, energized only from the network, is limited by the inherent low reactance characteristics of the three-legged core portion under unbalanced magnetization attending fault conditions. Grounding reactance is controlled by the reluctance proportioning of air gaps in the flux paths offered by the fourth and fifth legs. A supplementary non-magnetic shield of relatively low resistance surrounding the assembly both controls unbalanced magnetization loss and prevents undue heating in the tank itself.

Thus a generally negligible, inherent characteristic of three-phase, three-legged, core type transformer has been harnessed at low cost and put to work to help overcome low-voltage network service difficulties arising from generally negligible, inherent feeder capacitance.

Normally, network reverse power relays are designed to operate on reverse magnetizing current to network transformers so that feeders may be cleared by the simple operation of opening the feeder breaker at the generating station, network protectors operating automatically to clear the feeder from back-feed through the load. All might be well if all the network protectors on the feeder operated at exactly the same time, but since they do not, the system and its equipment must be made to perform successfully under the conditions of Fig. 1, where the feeder capacitance is energized from the network through the reactance of a single transformer and network protector. Two major troubles must then be overcome:

1. Until this last protector clears, a marked overvoltage, particularly dangerous from the standpoint of lamp burn-outs, exists on that portion of the network immediately adjacent to this protector.

2. High charging kva. both endangers the network transformer equipment from a heating standpoint and complicates the relay problem. It is difficult to apply network reverse power relay equipment which will meet other requirements with suitable margins and which will also operate on high reverse charging currents.

These difficulties have led to the installation of capacitance compensating equipment, though so far this has only been necessary in the supply of low-tension networks from 22- and 27-kv., three-conductor cable feeders.

The compensating devices first used were three-phase subway, star-connected, grounded-neutral, shunt reactors of 600-kva. continuous rating; gaps were used in each phase core leg to obtain proper magnetizing or shunt reactance. Essentially, characteristics were those of three single-phase, 200-kva. shunt reactors. Their conservative application required that a major portion of high-voltage network feeder charging current be neutralized. This requirement becomes particularly marked when consideration is given to the conditions existing during line-to-ground fault on a cable feeder which normally supplies power to a network through transformers with delta-connected primaries.

The generating station breaker opens automatically on fault current, thus removing the system ground, leaving one phase at ground potential and boosting the other two to at least normal line-to-line voltage above ground. Charging current and overvoltage increase markedly, as illustrated by the curves of Fig. 2.

The first step in minimizing the cost of this capacitance

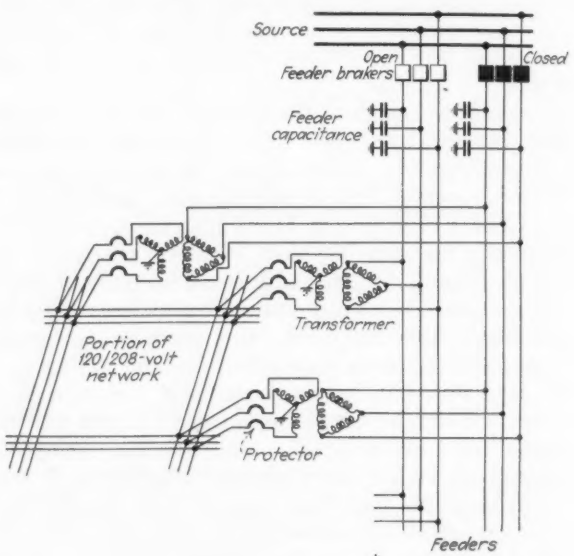


Fig. 1—Series resonance may arise from cable capacitance and network reactance

A 10-mile, 27-kv. cable feeder has approximately 1,250 charging kva. at normal voltage. The energizing reactance, that from the source, through the network and a single network transformer to the high-voltage feeder may be of the order of 20 to 40 per cent on a 1,250-kva. base. Thus, the condition of Fig. 1 may represent an intolerable partial series resonance where the result of feeding a 100 per cent capacitive reactance load through an inductive reactance of 30 per cent would be a rise in feeder voltage to 38½ kv. and an increase to 2,500 charging kva.

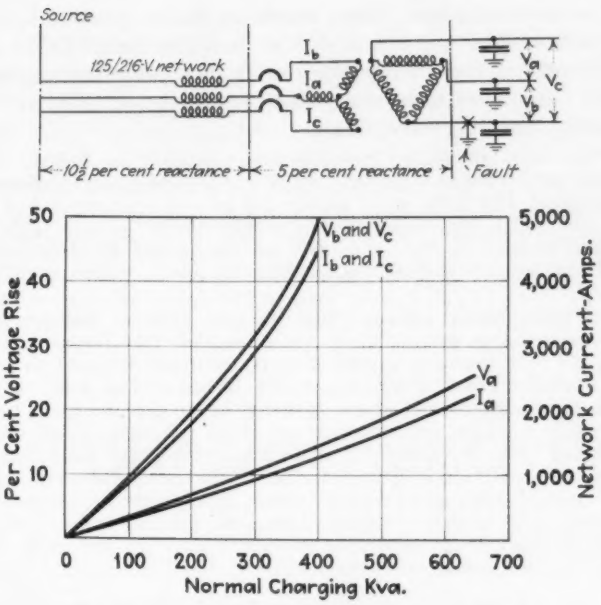


Fig. 2—Ground fault complicates voltage rise problem

For unfaulted feed-back the V_a and I_a curves apply to all phases. With fault as shown V_b and V_c, I_b and I_c are, however, markedly increased, a feeder with 225 charging kva. giving rise to about the same currents under ground fault as an unfaulted feeder with 600 charging kva. In this connection the term "ground fault" as here used applies to faults involving one phase and ground. Markedly different conditions, though less severe from the standpoint of overvoltage and relay operation, exist during faults involving more than one phase. Reactances are based on 500-kva. base.

limitation is to set limits on (1) allowable voltage rise on both the high-tension feeder and on that portion of the network immediately adjacent to the network protectors, and (2) magnitudes of allowable reverse charging current for reasonable relay design. As shown in Fig. 2, these two limitations are most severe under ground fault conditions, which, therefore, are determining when any device is applied which operates to effect exact compensation of a portion of feeder capacitance.

Composite device serves three functions

The Buffalo General Electric Company was faced with this problem in serving a low-voltage a.c. network from 22-kv. cables through delta high-side transformers. System tests were made which clearly indicated the increased difficulty under ground fault and manufacturers were consulted with the purpose of developing equipment most suitable for conditions thus determined. It became apparent that the installation of a grounding transformer with a neutral resistor on each feeder would improve both voltage and relay conditions under feeder ground fault, but that neither would help under balanced back-feed. After considerable investigation, a solution was reached through the development by the General Electric Company of a "grounding" reactor which includes in combination, first, a shunt reactor; second, a controllable grounding transformer action, and, third, a controllable loss under feeder line-to-ground fault.

Three separate functions which have been combined in the single device are shown in Fig. 3. The shunt reactor neutralizes as much of the cable capacitance as it requires to limit either the ungrounded voltage rise or charging current to a desired value. Referring again to Fig. 2, and a specific example where voltage rise under balanced condition is to be limited to 20 per cent, then 535 kva. represents the maximum allowable normal charging kva. Assuming that the cable involved has 1,000 charging kva. at normal voltage, then a shunt reactor having 1,000-535 or 465 kva. rating must be used. (This neglects network transformer magnetizing current which sometimes helps to reduce the required size of shunt reactor.)

The grounding transformer, in combination with the shunt reactor, operates to limit voltage rise or charging current under ground fault. Though its exact performance can only be calculated by symmetrical components, it is obvious that, if of infinite reactance design, it has no effect; if of finite high reactance design, it decreases voltage rise of V_b and V_c, and if of normal low-reactance design it may cause voltage drop on V_b and V_c instead of voltage rise. One reasonable possibility, where a long time rating design is necessary, passes sufficient current under ground fault to make V_b and V_c about the same as under the balanced condition. This also conforms to reasonable practice, for the same network voltage limitation exists under the two conditions.

In this 1,000 charging kva. example, if the voltage rise is not to exceed 20 per cent under any condition, then the above reasonable design grounding transformer, in combination with the 465-kva. shunt reactor, fulfills requirements. If a shunt reactor alone were used, by reference to Fig. 2, it becomes apparent that all save 210 charging kva. must be neutralized. The requirement is, then, 790 kva. continuous rated shunt reactor instead of 465. The grounding transformer therefore replaces 325 kva. of continuous rated equipment, decreases continuous loss proportionately and releases that 325 kva. for power-factor correction.

Reactor made with five-legged core

Most application engineers know that the three-legged core of three-phase core type transformers acts in many respects like a very high reactance tertiary delta. This is the inherent characteristic of three-phase, three-legged, core-type transformers which makes the grounding reactor possible. In transformer applications this characteristic is negligible when the primary, secondary or tertiary of the transformer is connected delta, as is the usual case. In the exceptional case, where no actual delta exists, it helps to suppress triple harmonic exciting currents and voltages. It is caused by the fact that any flux common to all three legs must return through the

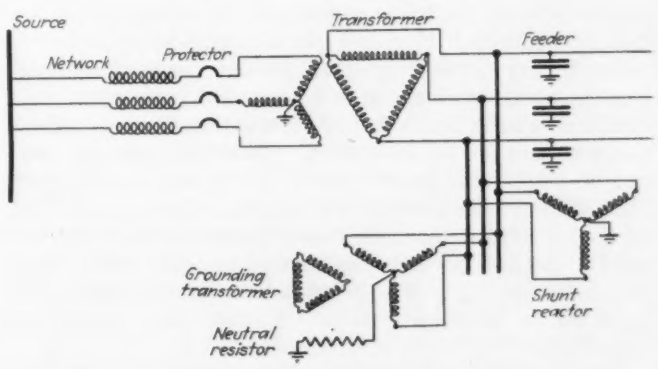


Fig. 3—Three functions performed by new design

Shunt reactance to compensate cable capacitance, grounding transformer action to limit voltage rises under faults and shielding to give desired losses.

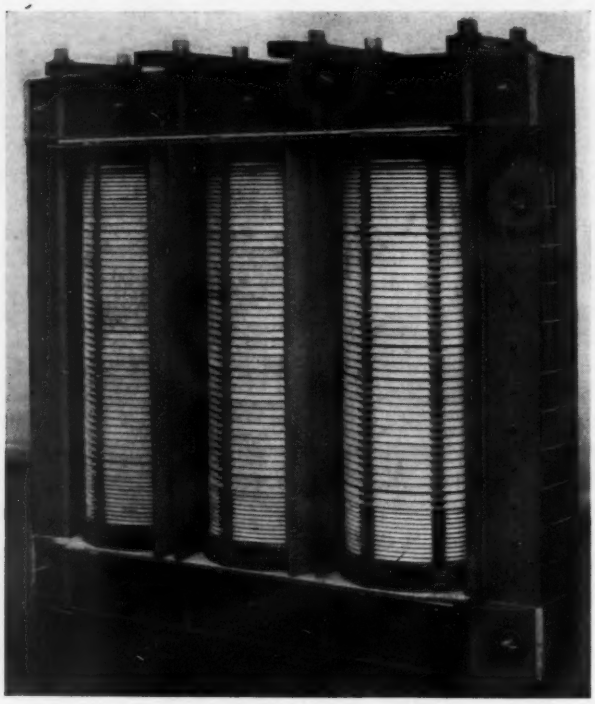


Fig. 4—Aif gaps in outer legs control zero-phase sequence reactance

Three-phase, 1,000-kva. grounding reactors for Brooklyn Edison 26.4-kv., 60-cycle cable feeds to low-voltage network.

air and transformer tank—high-reluctance paths. Under normal balanced, three-phase operation there is no common flux, since the fluxes of the three legs sum up to zero. It takes effect, therefore, only under unbalanced conditions, such as a fault which shorts the winding on one leg.

It then is possible to build a very high-reactance grounding transformer by using a three-legged core with suitable exciting windings on each leg for grounded star connection. As with the grounding transformer of standard design, only core magnetizing current would be drawn from the line under normal conditions. Control of grounding reactance can be incorporated through the addition of a controllable reluctance path so placed that it will serve as a return path for common flux. Such a path is readily provided by fourth and fifth core legs, with air gaps for reluctance control. This feature is limited, since the lowest obtainable grounding reactance is that resulting from the three-legged core, and inherent reactance with the three-legged core is too high for normal applications. However, in the application here considered, any grounding transformer must have high reactance to prevent overheating on prolonged fault duration, and it developed from test that the controllable range covers the field required. Obviously, further gaps can be introduced in the original three legs for the purpose of increasing normal magnetizing current (provided, of course, that sufficiently heavy excitation windings are used). Such a device, with control of both normal magnetizing and grounding transformer characteristics, becomes a combined shunt reactor and grounding transformer.

The feature of controllable loss under feeder line-to-ground fault is an obvious corollary. The flux path of air and tank parallels the fourth and fifth legs. A fairly low-resistance tank shield, completely surrounding the core and coils but inside the tank, forces practically all common flux to return within it. The controllable resistance of the shield determines its circulating current and loss under unbalanced system conditions such as the feeder line-to-ground fault.

Six such grounding reactors were installed in Buffalo and have performed as expected. Each has a three-phase continuous rating of 11.8 amp. at 22 kv. or 450 kva., a continuous loss of 3 kw. and a loss under system conditions of ground fault of about 55 kw. In this connection the loss in the shield is rather readily dissipated, since the shield is in direct contact with the tank.

System studies indicated that, to give suitable currents and voltages under ground fault, the grounding transformer action should correspond to a grounding transformer designed to pass a neutral current of 50 amp. under line-to-ground fault on an otherwise ungrounded 22-kv. system. When considered in combination with the 100 per cent zero phase reactance of the shunt reactor, this corresponds to an over-all zero phase reactance of 41½ per cent, which figure represents the zero phase reactance of each of these grounding reactors. Equipment is designed to operate for an hour without dangerous heating under line-to-ground fault on an otherwise ungrounded system and at 20 per cent phase-to-phase overvoltage.

New grounding reactors for the Brooklyn Edison Company are being installed in vaults where stringent loss limitations have two further effects:

1. The continuous loss of any device cannot exceed that value which will allow of its dissipation without exceeding 40 deg. C. ambient temperature. This limitation adds to the desirability of the grounding reactor as a compensating device since its grounding transformer action involves no continuous loss.

2. The one-hour heat storage capacity of the vaults used is not sufficiently high to warrant high loss under ground fault. This, in combination with the fact that voltage rather than relay limitations are determining, result in the use of a low loss tank shield.

More than 25 of these equipments are now being built by the General Electric Company for the Brooklyn Edison and New York & Queens companies; each is rated 1,000 kva. at 26.4 kv., has a continuous loss of about 5 kw., a weight of 10 tons and a zero phase reactance of 62½ per cent. Equipment is designed to operate for an hour under line-to-ground fault on an otherwise ungrounded system and at 23 per cent phase-to-phase overvoltage.

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Large Building Wiring Economies Require Changes

In the wiring of large commercial and industrial buildings costs can be reduced by applications of the same principles that have served to reduce costs on the utility distribution system. Numerous installations have been made in New York City where considerable saving has been made by installing transformers in the upper levels in the building. To operate such vertical networks properly it is necessary that secondary ties be provided between the transformer locations. These ties should be used to distribute load after the fashion of street mains.

But it has not been possible to secure approval of such distribution unless the intervault ties are fused for the rating of the conductor, declares H. R. Searing, New York Edison Company. Such fuses interfere with the

successful operation of the network system, but if these fuses are omitted or increased in size above the conductor carrying capacity it is not possible to use these ties for the distribution of building load on account of objections by the inspection authorities. The result has been that the intervault ties are paralleled with radial distribution circuits serving the building load.

If an agreement could be reached to put large fuses in these ties so as to give short-circuit protection, declares Mr. Searing, a compromise might be reached with a saving of money to all concerned.

Wiring in a large building should consist of a system of mains, gridironed around the floors, and between floors, in Mr. Searing's opinion, so that the service to a given portion of the floor space will be taken from the nearest main. These mains, in turn, would be served by individual transformers located at strategic points throughout the building, in the same manner in which transformers now feed into the street main system. However, thus far, it has been impossible to obtain favorable consideration for such arrangements, Mr. Searing reports.

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Your Job and Mine

By JOHN C. PARKER*
President Brooklyn Edison Company

Stage cleared for business recovery.
Legwork needed on present opportunities.
A realistic approach to work and sales needed.

THERE are clear indications now that the general process of business recovery may have set in. Your job and mine, in the long pull for re-employment, is to work through the realistic process of business recovery to open up the jobs that are essentially available. I believe the opportunity is fully at hand and that all of us working together can develop that opportunity into reality.

The process of recovery is not going to be a matter of days or weeks, and with all that's in me, I sincerely hope that it won't be so sharp and sudden that we again build an unstable structure, nor do I feel for one moment that recovery will be worked by any miracle nor handed to us from without our industry. International agreements, acts of Congress and propaganda may help or may hinder recovery. They can neither stop nor produce it, and the sooner we recognize that fact the more rapidly will genuine recovery set in.

The first step in the recovery process will be for us all individually to recognize that the day is past when a man can pin a note on his office door announcing that he has gone out for a golf game and requesting people who want to give him orders to drop them through the mail slit. Plain legwork of the old-fashioned type is the only thing that will produce business and enable us again to open up the channels of employment. I know that the opportunities are available if we will go after them.

There are in this borough 800,000 users of electricity. Hardly a one of these has his premises adequately and properly wired. Hardly a one of these uses what outlets he has to the full extent of his needs. Most of these 800,000 users content themselves with two or three foot-candles of illumination, when ten or twelve represent a fairly adequate standard. You know and I know that there are among these 800,000 many who have not ample buying power today. We know too that in that vast number of people there are many whose buying power, even though curtailed, can express itself in the purchase of some of the conveniences of life. Our experience during these three years has shown us that in the mercantile houses and in the factories there is need for modernization which, by relatively slight expenditure, can bring about economies in the use and application of electricity, whether those economies take the form of the elimination of waste or of more extended use; it easily may be that either or both of these will be indicated in some particular case.

Many influences have been at work to make it more easily possible now to produce a flow of business in our particular field. Unit costs are down. Whether we enjoyed that process or not when it first started in, the substantial fact remains that it is better to have a flow of business on a low price level than to have no flow of business at all on a sustained price basis.

Good, sound, substantial electrical merchandise is available today at prices one-half what we knew in 1929, and the managers of some distribution agencies are finding it possible to create a flow of business which could not take place with reduced buying power in combination with high unit costs. What I am saying here is that the unit costs have got down to the level of the buying power of the community.

The heads of our merchandising and contracting concerns and their immediate associates have time now to

**Abstract of address presented at the Brooklyn Electrical Industries Committee.*

sharpen their pencils and to use creative initiative in finding the ways and means to make business attractive.

I believe that three influences have been at work to hamper a proper flow of business in our field, and I think the time has come for us to remove those influences. The first influence consists in our own point of view. For nearly twenty years we have been in the habit of letting the business seek us. In the last three of these years we have perhaps felt that business just didn't exist, and still have waited for it to seek us. We have been in the habit of thinking in terms of large orders and have developed somewhat of a contempt for the small ones. I submit that if there is a possible fifteen-dollar appliance sale or a twenty-dollar wiring job that can sell a couple of dollars more of kilowatt-hours, you and I can go out and hunt that job. It costs no more to be out hunting for it than it does to sit back and wait for an automatic recovery that is not going to happen. If our time isn't employed anyhow, we can better afford to go out and ring ten doorbells with the request for permission to study the possibility of improved wiring, even though we will get only one order out of the process, than we can to rely solely on window displays and newspaper advertising which may create a desire without focusing it in action.

Let me specifically illustrate what I mean by this. Quite outside the electrical field, and including also two or three details in that field, I personally have at least a dozen home improvement undertakings which I definitely intend to carry through, but I have just been too busy to go or to get somebody to come around and estimate on them. If somebody had got after me and pointed out to me what any passerby can see, namely, that there is a fence around my place needing completion, that man could have had the order and I would have thanked him for getting me started. It's not too much to believe that among the 800,000 users of electricity in Brooklyn there are at least 200,000 in that very position, wanting to do business and just not getting around to it. If the average order that could be taken by that process is as little as fifteen dollars, there is three million dollars' worth of business to be had for the seeking, and all of it gives employment somewhere or other.

The next impediment consists in the prospective customer's own mind. With reference to appliances and modernization, many a prospect in this borough is doing the same thing that happened with reference to the investment market, waiting for things to go lower still, while we have today unit costs for wiring and unit costs for devices that are astonishingly low even to those who have any recollection of the pre-war level. Back in 1910 I ventured the prediction that ultimately we would have electric refrigerators selling at as low as $100. At that time the man who was rich enough could buy one for $900. Today the prices for these devices are right around the century mark. What we have got to do is to persuade the prospective customer that even though prices may, with the further development of mass production, became gradually lower than they are now, there is but little advantage in waiting for further and probable slight price curtailments at the expense of denying oneself in the meantime the comfort or the economy that can be had by taking advantage now of extraordinarily low price levels.

I believe that there is a third influence at work to delay recovery. Our industry has nearly become traditional with some of the bad things that go with a too hard tradition. You and I working together can take account of the influences that surround our business and determine whether some of our habits and some of our stipulations can be simplified to the end of cutting out fancied refinements which may be of little or no value and may frighten off business. Safety and convenience alike have been promoted in large measure by the standards of our industry. I know, however, that in my own company, when some of our standards come under close questioning, we find them not always to be justified. I believe there may be some element of this elsewhere in the industry. It is manifestly better by far to remove questionable restrictions than to have them continue as impediments in the way of the public in their enjoyment of what we have to produce.

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Synchronous Blower Motor Rides Through 30-Cycle Outage

By L. W. HAYWARD
Power Superintendent Tennessee Copper Company
Copperhill, Tenn.

Recently the Tennessee Copper Company tried out the effect of rapid breaker reclosure on its large synchronous motors. The main 66,000-volt feeder switch which controls the power to our Copperhill plant is equipped with reclosing relay to make three reclosing tests, first, fifteen seconds after "out"; second, 45 seconds after out and, third, two minutes after out, after which switch locks open if trouble still exists. The Tennessee Electric Power Company, which furnishes us with power, advised that it would be possible to make this feeder switch reclose instantaneously on its first test. To determine if instantaneous reclosure was desirable tests were made to find what would happen to our 1,200-hp., 3,600-r.p.m., synchronous motor-driven converter blower and our 450-hp., 200-r.p.m., synchronous motor-driven 100-lb. pressure reciprocating air compressor on instantaneous feeder reclosure.

The Copperhill plant load consists of approximately 700 hp. of small induction and synchronous motors, in addition to the 1,200-hp. and 450-hp. synchronous motors. Time-delay low-voltage relays are installed on the 1,200-hp. motor and 450-hp. motor and other smaller synchronous motors. No time-delay low-voltage relays are installed on induction motors. Relays are set with a two-second time delay. Arrangements were made to take oscillograph records of the current to the 1,200-hp. synchronous motor and of the 2,300-volt station bus voltage. The 1,200-hp. blower was loaded to approximately two-thirds load.

Blower motor rode through 32-cycle outage

The main 66,000-volt feeder switch at the power company's switching station, about one mile from the Copperhill plant, was tripped and allowed to reclose instantaneously. The reclosing time from instant of contact opening to instant of contact closing is 32 cycles. The 1,200-hp. synchronous motor gave a slight groan,

pulled an increased current momentarily, but stayed in step. The 450-hp. synchronous motor pulled out of step and relayed off by overload current. All the plant induction motor load and small synchronous motor load stayed on the line.

Oscillograms showed that voltage just before switch reclosed was 12 per cent less than the normal voltage, indicating that the synchronous motors were acting as generators to keep the station bus voltage up to this value during the 32 cycles the feeder switch was open.

To determine further the stability of the large synchronous motors a three-phase solid short was placed across a 66-kv. oil switch on a short line about one-half mile from the switching station.

The 1,200-hp. motor gave an awful groan, but stayed on the line. The 450-hp. motor pulled out of step and overload current relays took motor off the line. Other smaller synchronous motors driving the motor-generator set and pumps stayed on the line. About 50 per cent of the induction motor load was dropped. The oscillograph record shows that the motor current to blower was very high when short occurred and gradually dropped until short was cleared. The station bus voltage dropped very rapidly. The short was cleared in 34 cycles. The synchronous motor driving the converter blower and the motor driving 100-lb. pressure air compressors are not designed to start under load. Blower and compressors are unloaded before starting and if they pull out of step they have to be unloaded to resynchronize.

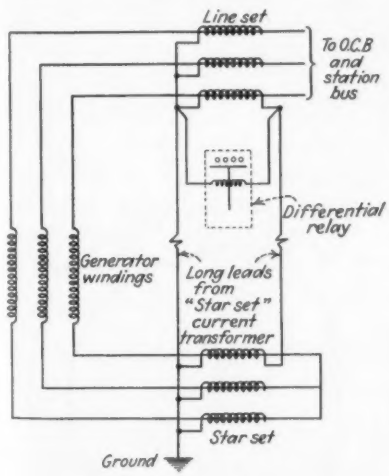
These tests showed that instantaneous reclosure is desirable and that most synchronous motors will ride over the reclosure period. The slow-speed reciprocating air compressor motors, however, will not ride over the reclosure period, but as there was only one motor of this type in operation out of 300 on our 66,000-volt feeder it was felt that instantaneous reclosure was desirable. The oscillograph records show that the large synchronous motor tends to hold the voltage up on station bus at the time of reclosure and this feature has made a marked reduction in motor kick-offs since the 1,200-hp. motor was put in operation. Many voltage dips that used to kick our 300 motors off now have no effect on their operation whatever. The large synchronous motor holds the station voltage during the power dips, thus serving a purpose similar to time-delay low-voltage relays.

▼ ▼ ▼

Differential Relays Operate Abnormally Due to Different Lead Lengths

By S. EIN
Hammond, Ind.

In one of the power stations of a large steel mill in the Midwest differential relay protection was recently added to the four 2,000-kw. units, and while the relays were not intended nor expected to do so, they now effectively protect the machines from damage that might result from careless synchronizing. After this work had been completed and the generators again placed in service the operators were startled to see that whenever a generator was connected to the bus a trifle out of phase one or more of the differential relays would act to trip open the oil circuit breakers. An investigation disclosed the cause, which was that the amount of wire between the star set and the relays averaged about 500 ft. more than that between the line set and the relays. Knowing this, the following interpretation was developed:



Protects against careless synchronizing

The generators are at an average distance of 250 ft. from the room containing their oil circuit breakers, the station's main bus and the operators' board. The secondary leads of the star-set of current transformers are led through one conduit to the secondaries of the line set and there connected to short leads from the terminals of its transformers. From these splices taps are taken and led through another conduit to the differential relays in the operators' room.

While the two current transformers are presumably identical in construction, their ratios are alike only at normal loads. When a generator is connected to the station bus out of phase the current rises to an abnormal amount through the primaries of the transformers. The high current flowing through the current transformers increases their flux densities to nearer saturation. As a result, minor variations of construction make themselves evident to destroy the true ratios, because one transformer takes a higher exciting current than the other. Moreover, the burdens of the two current transformers are not alike. That of the one in the star can be considered as all the wire or 500 ft. of 19-22 stranded cable, a load of 10 volt-amperes at 100 per cent power factor. The burden of the one in the line is the relay and its short leads, a load of about 30 volt-amperes at 40 per cent power factor. Both are based on 5 amp. and 25 cycles. This difference of loading causes one transformer to operate at a higher density than the other and thus further magnify its increase of exciting current and the consequent change in ratio. More current flows through the differential relay coil and it operates to trip the generator oil circuit breaker.

Realizing that the added function does little harm, changes have not been made in the connections. An occasional tripping off of a generator when it is being synchronized upon the bus is not particularly harmful and causes the operator to use more than ordinary care. In addition, there is a distinct advantage in the condition; that is, the differential relays are occasionally given a perfectly convincing test. Thus it is known that the protective equipment is always ready to function.

House Heated by Pump with 5 to 1 Pick-up Ratio

By GILBERT WILKES* and R. E. MARBURY†

APPLICATION of a heat pump—that is, a reversed refrigeration cycle—to the heating of buildings is receiving attention on both the theoretical and practical sides. For several years work on these devices has been conducted at Reading and winter results indicate that a heat pick-up ratio of 4.5 or 5 to 1 can be attained. From a commercial standpoint for the utility, the heat pump seems to present great opportunities as a load builder. In opposition to certain other methods of electric heating of buildings, the heat pump can use electricity at a rate attractive both to the utility and to the consumer.

Taking the pick-up ratio as 4.5 to 1, including fan power (which in these tests was higher than it need be), a 2-cent energy rate places the cost of 1,000,000 B.t.u. at $1.30. The efficiency of a coal-fired hot air heater over a season in the particular house installation reported here is computed to be 40 per cent. Coal of 13,500 B.t.u. per pound at $15 per long ton makes a million useful B.t.u. cost $1.24. When used in a well-designed heat pump 2-cent energy is thus equivalent to a coal cost of $15 per ton in moderate climate areas. Both these costs are within the present range of prices in many sections. The added advantages of convenience, cleanliness, proper air conditioning and cooling in summer obtainable in a heat pump seem to indicate that a device of this nature, should it be rendered practicable, could be easily marketed and might be influential in causing a resumption of the normal rate of utility load growth.

The basis of design has been to secure a device giving a heat pick-up ratio of 5 to 1 which would satisfy the cost conditions. With this in mind it was deemed best to utilize the direct transfer of heat from the outside atmosphere to the refrigerant and from the refrigerant to the inside atmosphere, so as to eliminate the losses of efficiency inherent to multiple transfers of heat, and in the auxiliary power required to move quantities of water or air to secure the different heat transfer. This consideration pointed to the use of a safe refrigerant which was not commercially known at the initiation of the experiments. It was, however, expected that when the need became sufficiently important for a refrigerant of the type required one would become commercially available.

As small a motor as possible was used so as to cause the minimum line disturbance on starting and thus render its use on existing networks possible.

A small bungalow was first erected. In this experimental house a small compressor driven by a 1-hp. motor through a two-step sheave system discharged into two direct heaters of the fin type located on the north and west walls. The heat absorber, of the natural circulation non-frosting type, was located in a sunny exposure. The heat release of this house was checked by the use of a direct electric heater during certain periods. Energy to this heater was metered and the indoor and outdoor temperatures were recorded, so as to secure a measure-

*Engineering department, W. S. Barstow & Company, Reading, Pa. †Manager supply engineering department, Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa.

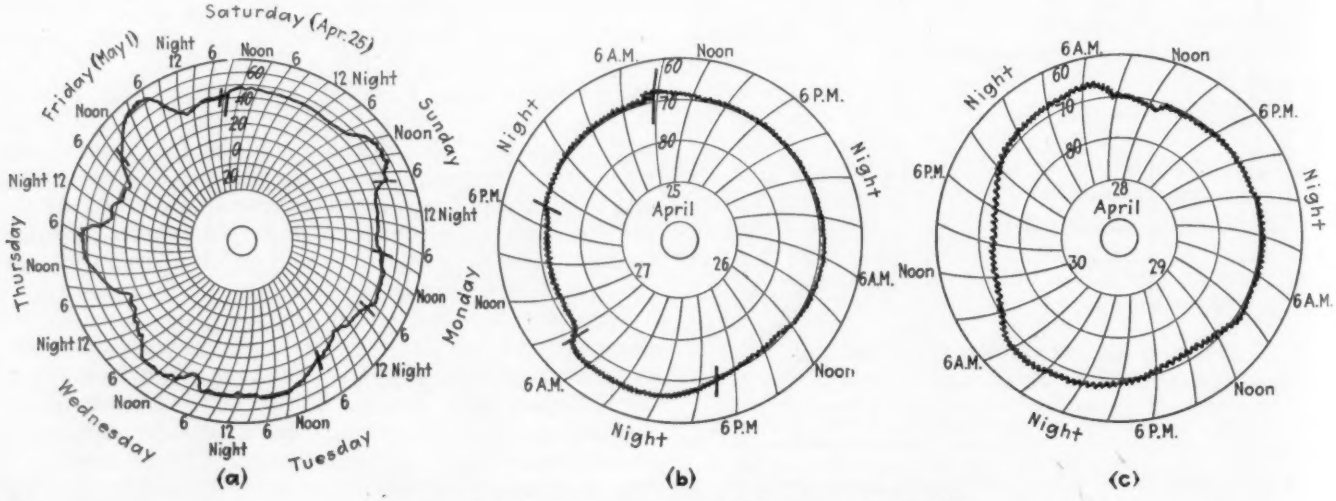


Fig. 1—Good temperature regulation found possible

(a) Seven-day chart of outdoor temperature. (b and c) Two three-day charts of indoor temperatures for same period.

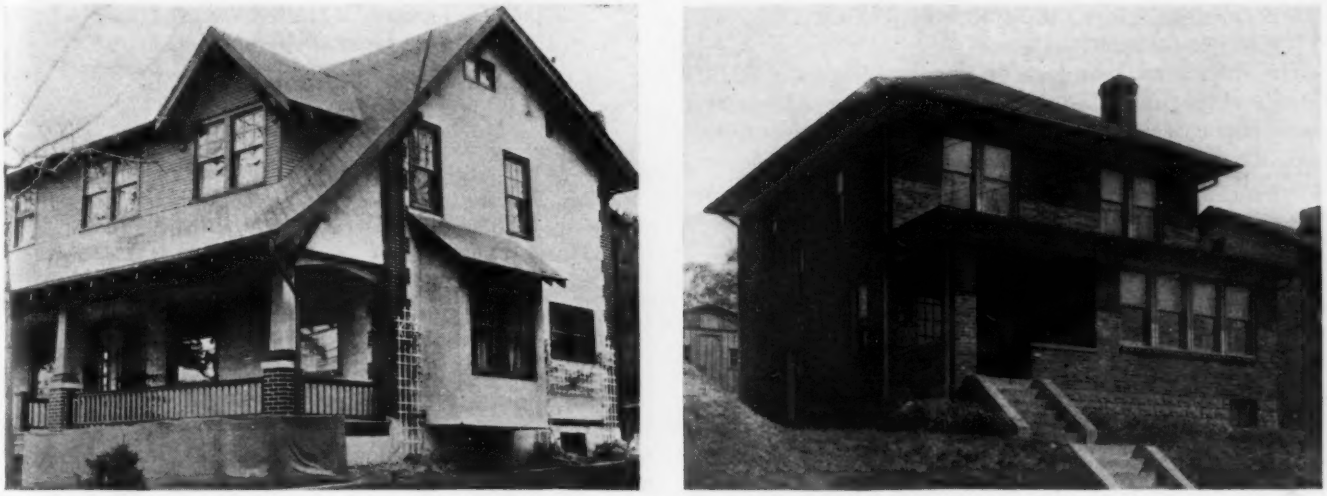


Fig. 2—Houses heated by means of heat pump

(Left) Outdoor heat exchanger in rear. Unit in cellar designed to maintain 70 deg. F. by supplying 70,000 B.t.u. per hour when outdoor temperature is zero. (Right) Further developments being studied in this house near East Pittsburgh.

ment of the heat radiated by the building at different temperatures. Prorating this data, the heat released from the building was found to be 9,000 B.t.u. in zero weather.

The indoor radiation was designed to release its heat under a temperature differential of 30 deg. F., and the outdoor surface under a temperature differential of 20 deg. F. With a 70 deg. indoor temperature and a 0 deg. outdoor temperature, for instance, the evaporator would operate at —20 deg. F. and the condenser at +100 deg. F.

Sulphur dioxide was used in the system. The lowest compressor speed, corresponding to a piston displacement of 5.3 cu.ft., was used entirely, but 0 deg. weather, for which the higher speed was provided, was not encountered.

This unit was controlled by a standard thermostat having an off and an on position. The influence of the starting and stopping of the unit is readily recognized on the indoor temperature charts (b and c of Fig. 1), which are representative of the regulation obtained. In spite of our efforts it was not possible to locate the recording thermometer so that it recorded exactly the calibrated thermostatic temperature. In windy, cold weather the drafts in the house seemed to have a greater influence on the recorder than on the thermostat. This is particularly noticeable on the indoor temperature chart (Fig. 1c).

The average ratio of heat pick-up secured in this installation was 3 to 1. Comparing the known mechanical efficiencies of this equipment with those of a standard installation, a heat pick-up of 4.5 to 1 could be predicted for a normal unit. By incorporating certain refinements in design it was felt that the desired heat pick-up ratio of 5 to 1 could be secured.

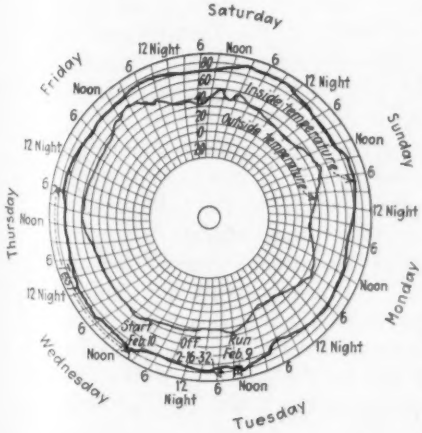


Fig. 3 — Temperature more uniform than with coal heating

Wednesday and Thursday run with heat pump on. Remainder of February week on coal heater. Outdoor weather ranged from 16 to 60 degrees F. Indoor temperature ranged from 63 to 81 degrees F. with coal and from 74 to 79 degrees F. with heat pump.

During the warm months tests of this bungalow installation were performed to determine the possibility of cooling by means of direct radiation. The difficulty of carrying away from this radiation the moisture condensed during cooling periods, combined with the frosting of these surfaces and the difficulty of preventing air stratification, showed that the indirect type of system was preferable to the direct radiation system, at least where cooling was necessary.

As this bungalow was not inhabited, and as it was intended mainly to demonstrate in a practical way the possibilities of reversed refrigeration, little attempt was made to eliminate the noise of the mechanical equipment. At the conclusion of these experiments the importance of securing the additional benefits of complete and proper air conditioning at all times and the greater facility of noise elimination in an indirect system using circulated air were such that the idea of using direct radiation was abandoned.

The next installation was made in the residence shown in Fig. 2 (left) and it was of the indirect type. The natural circulation outside surface in the bungalow test had operated under all conditions without frosting, and it

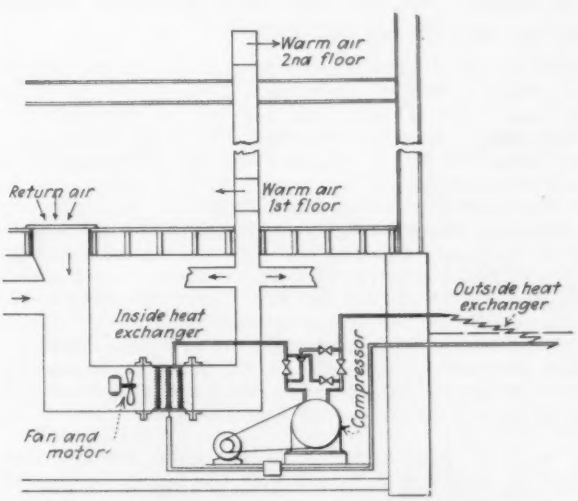


Fig. 4—Heat pump arranged for heating or cooling and humidifying

was decided to retain the same type of heat exchanger in the larger installation.

The calculated heat loss of this building was 70,000 B.t.u.'s per hour in 0-deg. weather and the outside and inside surfaces were both designed to operate under temperature differentials of 30 deg. F.

The useful volume of the living quarters in this house is approximately 12,000 cu.ft., exclusive of attic and basement. The air was to be moved through the indoor heat exchanger at the rate of 2,000 cu.ft. per minute, so as to secure a complete recirculation of air every six minutes. The inside heat exchanger incorporated features of counterflow and humidification, which permitted some reduction in the surface of this unit. The heat pump installation comprised, furthermore, a 7½-hp. motor, a 40-cu.ft. variable speed compressor and suitable means for controlling automatically the speed of the compressor by means of a thermostat located in the living quarters, and an automatic humidifier. The unit was designed to deliver 70,000 B.t.u.'s to the circulated air during 0 deg. weather while maintaining a house temperature of 70 deg. F. Stopping and starting of the unit at short intervals was prevented by the automatic adjustment of speed to the heat requirements. During the summer months the unit was to maintain a house temperature 15 deg. below the outside temperature, to decrease the humidity to a fixed constant value and also to reheat to a comfortable point the air delivered to the living quarters after dehumidification.

Table I gives a typical operation of the unit as a heater during average winter conditions. The electric energy consumption is that of the heat pump proper and does not include the fan power.

The danger of frosting the outside surface loomed so great while this machine was being designed that special attention was devoted to the operation of the machine during the worst frosting conditions experienced during the past winter. The log of the operation of the heat pump during this period is shown in Table II. This period started with rain and sleet of several hours' duration, followed by fog without wind for the balance of the time. The total duration of these especially severe frosting conditions was about 36 hours.

Maximum heat demand results in 9.4-kw. load

The outside heat absorber in this installation is made up of six units, arranged in a substantially horizontal bank of four units, with two units directly underneath the outer units of the upper row. This placed two units of the upper row in a position where the access of air was difficult. During this frosting period it was found that some frost did build up on the unventilated portions of the surface, although this condition did not materially affect the operation of the unit.

Tables I and II show the typical operation of the heat pump under average weather conditions and under extreme frosting conditions. Table III gives an idea of the operation of the machine under maximum capacity. These conditions were obtained during last March, which afforded the coldest and windiest weather encountered.

In examining the data of this table it must be borne in mind that the actual measured fan capacity was 1,835 cu.ft. per minute. This corresponds to an actual heat output of the machine, neglecting the heat absorbed by the humidifying water, of somewhat more than 100,000 B.t.u.'s per hour for peak periods. These extreme conditions, of course, existed only for short periods due to the manipulation of the thermostat by the residents. It will be noticed also that whereas the rated compressor motor input is 6.6 kw., this input rose to 9.4 kw. during short periods, when the maximum demand for heat existed.

It was deemed advisable at the time the installation was made to place it in a house having a normal occupancy, so that a fair check on any features constituting a nuisance could be secured. The house chosen was

Table I—Two-and-a-Half Kilowatt-Hours per Hour in Winter

January 4, 1932 — Average Weather Condition

Time		Outside Temperature			Indoor Temperature				
From	To	Dry	Wet	Relative Humidity	Dry	Wet	Relative Humidity	Weather Condition	Electrical Energy, Kw.-Hr.
9:40 A.M.	10:30 A.M.	38	34	0.66	71	63	0.64	Cloudy	1.5
10:30 A.M.	11:10 A.M.	39	33	0.51	72	63	0.61	Cloudy	0.5
11:10 A.M.	12:10 P.M.	39	34	0.59	72	62	0.57	Cloudy	3.0
12:10 P.M.	1:10 P.M.	39	36	0.75	71	62	0.60	Cloudy	3.0
1:10 P.M.	2:00 P.M.	39	34	0.59	71	62	0.60	Cloudy	2.0
2:00 P.M.	2:30 P.M.	39	35	0.67	71	62	0.60	Cloudy	2.0
Average.....		39	34	0.63	71	62	0.60		

equipped already with a natural circulation hot air system and the existing coal-fired hot air heater was left in the house to take care of inspection periods and alterations to the heat pump.

The heat pump maintained a considerably more constant temperature than was possible with the coal-fired heater (see Fig. 3).

As the house was occupied during the whole period of the tests, it was essential to utilize a safe refrigerant, so as to prevent any obnoxious results from leaks, which were to be expected in an experimental installation of this nature. Dichloro-difluoro-methane was used entirely.

In actual operation it was found that some leaks at unexpected points persisted to a small degree in spite of all the care taken to prevent them. These were attributed more to defects in machinery than to anything else, and steps are now being taken to eliminate them in future units. New heat pump units are now in process of design in co-operation with the Westinghouse Electric & Manufacturing Company.

The noise that our first installation had shown to be of main importance persisted to a considerable extent. It seemed to be comparable in volume to that caused by the average oil burner, but its pitch was considerably higher and therefore more annoying. It is felt that some of this noise was generated by the mechanical speed changer. Some considerable part was caused by valve and gas squeaks in the compressor.

These noises did not travel so much through the ducts, which were treated for noise absorption for a distance of approximately 8 ft. from the heat pump cabinet, as through the building foundations and from the pipes carrying the refrigerant from the outside surface. The outside surface itself created some noise from the boiling action of the refrigerant.

In common with many other experimenters using dichloro-difluoro-methane, we found that this refrigerant in liquid form binds easily in restricted portions of the equipment. It was found necessary to use liquid pipe lines as large as ¾ in. wherever the liquid was expected to flow by gravity under a head of a few inches. The heaviness of the gas causes a reduction in the volumetric displacement of the compressor when standard port areas and valves are used. These areas should be substantially larger for this new refrigerant than for the older type refrigerants.

Although it is too early to discuss the operation of this equipment as a cooling unit, it has been tested during the warmer days experienced so far this season. It has been found that a reduction in moisture content of the air of as much as seventeen grams per pound is possible under certain conditions, corresponding to an extraction of moisture from the residence of about 20 lb. per hour. With an outdoor temperature of 80 deg. F. in the shade, with full sun on the southwestern exposure of the house, the air temperature out of the machine

Table II—Frosting of Outdoor Exchanger Raises Energy Consumption

Time	Meter, Kw	Deg. F. —Temperature— Outside	Inside		—Machine— Start	Stop	Remarks
			Dry	Wet Dry			
February 10, 1932							
9:30 a.m.	108	36	..	74	9:30	10:00	Thermostat set at 76 deg.
10:30	110	37	..	78	10:10	10:35	started at 10:10 a.m. Humidity spray started 11:30 a.m.
11:30	110	38	36	76	11:30	12:00	Cloudy
12:30 p.m.	112	40	37	76	12:32	1:14	Little sun
1:30	116	42	39	76	1:41	.....	Cloudy
2:30	120	42	31	76	3:06	2:36	.....
3:30	122	42	39	75	.....	.....	Rain, Sleet
4:00	125	42	40	75	.....	.....	Rain, Sleet
4:30	127	42	40	75	.....	.....	Rain, Sleet
5:00	128	42	40	75	.....	.....	Rain, Sleet
5:30	131	41	39	74	.....	.....	Rain, Sleet
6:20	135	41	38	75	.....	6:45	Rain, Sleet
7:30	138	41	38	76	7:30	7:55	Rain, Sleet
8:30	140	41	38	76	8:30	9:28	Cloudy
9:30	145	41	38	76	.....	....	Clear, No wind
10:30	150	41	38	76	11:17	10:35	Clear, No wind
11:30	152	41	38	75	.....	.....	Clear, No wind
12:30	160	42	39	78	.....	12:30	Fog, Cloudy, No wind
February 11, 1932							
1:30 a.m.	160	42	39	76	1:42	.....	Fog, Cloudy, No wind
2:30	165	41	38	76	.....	.....	.....
3:30	170	41	38	77	4:20	3:30	Fog, Cloudy, Very light wind
4:30	172	41	38	76	.....	.....	Fog, Cloudy, Very light wind
5:30	177	41	38	76	6:08	5:40	Fog, Cloudy, Very light wind
6:30	180	41	39	76	.....	7:05	Fog, Cloudy, Very light wind
7:30	182	41	38	76	7:30	.....	Fog, Cloudy, No wind
8:30	186	41	39	76	8:40	8:10	Fog, Cloudy, No wind
9:30	190	41	39	76	10:03	9:25	Fog, Cloudy, No wind
10:30	198	45	41	76	11:08	10:42	Fog, Cloudy, No wind
11:30	200	46	42	76	12:15	11:35	Fog, Cloudy, No wind
12:30 p.m.	203	47	44	76	.....	12:45	Fog, Cloudy, No wind
1:30	205	48	45	75	1:30	.....	Fog, Cloudy, No wind
2:30	209	48	46	76	3:05	2:30	Fog, Cloudy, No wind
3:30	210	48	46	74	.....	.....	Cloud, Light wind
4:30	218	48	45	76	.....	4:10	Cloudy, Brisk wind

Table III—Severe Weather Taxes Capacity of Equipment

(March 7-8, 1932)

Time	Meter Reading, Kw.	— Fan — Suction	Discharge	Deg. F. Temperature Outside	Inside D*	W	Remarks
8:00 p.m.	225	70	96	23	81	..	Fair, Moderate wind
9:00	229	68	98	21	76	68	Fair, Moderate wind
10:00	235	63	101	20	78	70	Fair, Strong wind
11:00	240	64	101	19	77	70	Fair, Strong wind
12:00	247	62	98	18	74	67	Fair, Strong wind
1:00 a.m.	251	60	82	17	71	65	Fair, Srtong wind
2:00	255	58	82	16	69	63	Fair, Strong wind
3:00	259	56	76	16	66	60	Fair, Strong wind
4:00	264	54	83	14	65	59	Fair, Strong wind
5:00	271	56	100	14	67	61	Fair, Strong wind
6:00	282	56	102	14	67	62	Fair, Strong wind
7:00	290	56	102	14	68	62	Fair, Strong wind
8:00	300	58	104	15	69	62	Fair, Strong wind
9:00	309	58	104	18	70	63	Fair, Strong wind
10:00	318	58	108	18	71	64	Fair, Strong wind
11:00	329	58	109	20	71	65	Fair, Moderate wind
12:00	338	60	110	22	72	65	Fair, Moderate wind
1:00 p.m.	348	62	112	24	74	67	Fair, Moderate wind
2:00	353	60	102	23	73	65	Fair, Moderate wind
3:00	359	62	100	25	73	66	Fair, Moderate wind
4:00	363	61	98	25	72	65	Fair, Moderate wind
5:00	369	61	98	24	72	66	Fair, Light wind
6:00	375	60	98	23	72	65	Fair, Light wind
7:00	381	60	98	20	72	65	Fair, Light wind
8:00	388	60	98	19	72	65	Fair, Light wind
9:00	394	60	98	18	74	67	Fair, Light wind

*Note — The indoor temperature started falling shortly after midnight due to the thermostatic control switch being manipulated by residents before retiring. This was corrected by test attendant as soon as noticed.

averages approximately 70 deg. F. and insures conditions well within the comfort range in the dwelling.

The winter operation of this machine indicates that an average heat pick-up of five heat units to every unit purchased from the utility was secured in the heat pump proper. The fan consumption was somewhat higher than expected and offset to some degree this ratio. The heat pump consumption would vary of course for different climates.

There are many problems yet to be solved before this type of equipment becomes commercial. From an operating point of view it is desirable to run the compressor at variable speeds. This, as pointed out above, was accomplished by a mechanical speed changer. This is not the ultimate solution of this problem and it is quite likely that a variable-speed motor drive will be excessive in first cost. When a constant-speed compressor is used with frequent starts and stops the problem of starting current may become quite objectionable, particularly in residential districts where three-phase power is not available.

The Westinghouse Electric & Manufacturing Company is now carrying on further experiments on reverse refrigeration at the air-conditioned house shown in Fig. 2 (right), located near East Pittsburgh, Pa.

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Different Lighting System for Coal Mines

Several advantages are claimed for a system of lighting coal mines described by W. Cramp recently*: Simplicity of connections; low voltage employed on each primary and secondary circuit, and possibility of removing or extinguishing any lamp without opening a switch for the purpose, and yet without any risks from sparking. Professor Cramp stated that modern mining conditions involve the use of much complicated machinery at the face of the coal, and that such machinery could not be worked safely and efficiently without adequate light. The usual illumination is far too small, and yet the only satisfactory way of increasing it is to supply lighting circuits from the power mains, an arrangement hitherto precluded in gassy pits because of the obvious dangers. His proposal is an attempt to render such a supply from the power mains safe, flexible and convenient.

The system proposed is arranged as follows:

1. From each phase of a lighting transformer fed from the power mains a series circuit is connected between phase and neutral, the neutral wire being earthed.

2. In each such circuit the primaries of a number of special transformers are connected in series without switches. The secondary of each transformer feeds one lamp in an appropriate fitting.

3. The transformers are constructed so that the lamp, "tail," secondary and "yoke" can easily be withdrawn as one unit; this is the method of extinguishing or removing a lamp.

4. The characteristics of the transformers are such that no matter whether a lamp be in place, withdrawn or even short-circuited, the primary circuit will not be disturbed substantially.

5. The lamp thus becomes the most vulnerable portion of the circuit, and it is proposed to employ a lamp fitting provided with a glass, which will withstand the shock of an explosion or of shot firing. In this case the secondary voltage would be either 12 or 25.

*British Society for Advancement of Science.

Men of the Industry

Edison Medal Awarded to Bancroft Gherardi

The Edison medal for 1932 has been awarded by the American Institute of Electrical Engineers to Bancroft Gherardi, vice-president and chief engineer of the American Telephone & Telegraph Company, "for his contributions to the art of telephone engineering and the

development of electrical communication." The Edison medal was founded by associates and friends of Thomas A. Edison and is awarded annually for "meritorious achievement in electrical science, electrical engineering, or the electrical arts" by a committee consisting of 24 members of the American Institute of Electrical Engineers.

Mr. Gherardi's entire professional and business career has been devoted to the art of communication. Coming into this field in 1895, when the telephone art was very young, he has played a most important part in the development and perfection of operating practices and in the development of methods, equipment and apparatus which have brought telephone communication to the high state of perfection in which we find it today.

He is a past-president of the American Institute of Electrical Engineers and at various times has served as a member of various committees, including the executive, Edison medal, finance, headquarters, public policy, of which he is at the present time chairman; research and constitutional revision. He has represented the Institute upon the board of trustees of the United Engineering Trustees, Inc., the library board, the National Research Council, the U. S. National Committee of the I.E.C., the John Fritz medal board of award, and other bodies, having served as president of the United Engineering Trustees, Inc., and as chairman of the John Fritz medal board of award.

L. F. Benz, for the past six years district supervisor of the Kansas Electric Power Company, Emporia, has been named vice-president and general manager of the Missouri Gas & Electric Service Company, with headquarters in Lexington, Mo. In this new executive position Mr. Benz is succeeding the late Worth Bates.

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C. Jay Goodnough, whose term as a member of the Pennsylvania House of Representatives, in which he was Speaker, has expired, has been appointed a member of the Pennsylvania Public Service Commission to succeed Emerson Collins, who resigned last October because of ill health.

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Jarius F. Burt, assistant general sales manager of the Western Massachusetts Companies, Springfield, has been appointed sales manager of the affiliated Pittsfield Electric Company, succeeding Ernest W. Nelson, who resigned recently to enter private business.

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Dr. Whitehead Nominee for A.I.E.E. Presidency

Dr. John B. Whitehead, who was nominated last week for the office of president of the American Institute of Electrical Engineers (Electrical World, December 10, page 769), is well known to the electrical industry as an educator,

engineer and scientist, whose original investigations and research work have won recognition not only in this country but also abroad. He has been associated with the teaching staff of Johns Hopkins University for 35 years and has been dean of the school of engineering of that institution since 1919. Details of Dr. Whitehead's distinguished career were published in the Electrical World, December 12, 1931, page 1059.

OBITUARY

George P. Baldwin

George P. Baldwin, a vice-president of the General Electric Company since 1925, died suddenly December 7, of pneumonia, in his fifty-ninth year. Mr. Baldwin was in charge of activities connected with the electrification of steam railroads and performed such other duties as were assigned by Gerard Swope, president of the company.

A native of California and a graduate of Leland Stanford University, Mr.

Baldwin was identified with the Stanley Electric Manufacturing Company when it was bought by the General Electric organization in 1903. He then became vice-president of the Blaisdell Company of Los Angeles, where he remained until 1910. In that year he transferred his interests to the East, assuming the duties of manager of the Pittsburgh office of the General Electric Company. Five years later he was made manager of the Atlantic district with headquarters in Philadelphia. When the merchandising department was created in 1923 he was made its first manager. Mr. Baldwin's headquarters were in New York.

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Ralph B. Williamson, vice-chairman of the Federal Power Commission for the past two years, died suddenly, in his home in Washington, D. C., at the age of 53. He had been in ill health for a year or more. Mr. Williamson was one of the best-known irrigation and water-power experts in the Pacific section of the country. From 1905 to 1910 he was the legal adviser of the Federal Reclamation Service and was also one of the men mainly responsible for the Washington State water code. Certain studies he had made and recently completed were the basis for amendatory legislation recommended by the power commission to strengthen regulatory provisions of the law creating the commission. Mr. Williamson was a former president of the Washington State Bar Association and of the Irrigation Institution of that state.